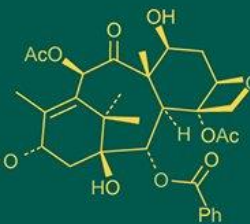
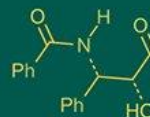


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Gaikwad GB

Ph.D. Scholar, Department of
Fruit Science, Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Malshe KV

Agronomist, Regional Coconut
Research Station Bhatye, Dr.
Balasaheb Sawant Konkan
Krishi Vidyapeeth, Dapoli,
Ratnagiri, Maharashtra, India

Kulkarni MM

Associate Professor, College of
Horticulture Dapoli, Dr.
Balasaheb Sawant Konkan
Krishi Vidyapeeth, Dapoli,
Ratnagiri, Maharashtra, India

Mane AV

Deputy Director (Seed),
Directorate of Research, Dr.
Balasaheb Sawant Konkan
Krishi Vidyapeeth, Dapoli,
Ratnagiri, Maharashtra, India

Kshirsagar PJ

Associate Professor, College of
Agriculture Dapoli, Dr.
Balasaheb Sawant Konkan
Krishi Vidyapeeth, Dapoli,
Ratnagiri, Maharashtra, India

Corresponding Author:**Gaikwad GB**

Ph.D. Scholar, Department of
Fruit Science, Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Influence of rejuvenation practices on flowering behaviour of alphonso mango (*Mangifera Indica* L.) under Konkan agro-climatic conditions

Gaikwad GB, Malshe KV, Kulkarni MM, Mane AV and Kshirsagar PJ

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Abstract

A field experiment was conducted at Centre of Excellence for Mango at Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli Dist. Ratnagiri, Maharashtra during the year 2023-24 and 2024-25. A single experiment comprising two seasonal trials was conducted. The experiment was laid out in a factorial randomized block design with two factors: Factor A consisted of rejuvenated and non-rejuvenated trees, while Factor B comprised seven plant growth regulator treatments, resulting in a total of fourteen treatment combinations, each replicated thrice. Post flowering foliar application of plant growth regulators can't change flowering behaviours of Alphonso mango under study. Rejuvenation practice significantly alter the flowering character in mango. Irregular and erratic flowering in Alphonso mango is influenced by its genetic makeup as well as prevailing climatic variations. Rejuvenation of old trees improves tree vigour, canopy management and resource utilization, which consequently enhances flowering intensity and regularity in mango.

Keywords: Rejuvenation tree, hermaphrodite flowers, Alphonso, orchard, sex ratio

Introduction

Mango (*Mangifera indica* L.), popularly known as the "King of Fruits," is one of the most important commercial fruit crops cultivated in India. Among the numerous cultivars grown, Alphonso occupies a prominent position owing to its exceptional fruit quality, unique flavour, attractive saffron-coloured pulp and high export potential. The Konkan region of Maharashtra is recognized as the natural home of Alphonso mango, where the crop thrives under humid coastal climatic conditions characterized by moderate temperatures, high relative humidity and well-distributed rainfall. Furthermore, the red lateritic soils of the Konkan region, which are slightly acidic, well-drained and rich in iron and aluminium oxides, provide an ideal edaphic environment for successful cultivation of Alphonso mango. A substantial proportion of Alphonso orchards in the Konkan region consists of old and senile trees exhibiting declining productivity, poor canopy architecture, reduced fruit retention and inferior fruit quality. Rejuvenation through strategic pruning has emerged as an effective orchard management practice to restore tree vigour, improve canopy efficiency and enhance productivity in such aged orchards. However, rejuvenated trees often experience substantial fruit drop during the early stages of fruit development, thereby limiting their yield potential.

Materials and Methods

The experiment was conducted in 35 years old Alphonso mango orchard at the centre of excellence for mango Dapoli during the two seasonal consecutive trials in the years 2023-24 and 2024-25. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replication.

Treatment details

Factor A	Particulars
P ₁	Rejuvenated tree (35 year old)
P ₂	Non Rejuvenated tree (35 year old)
Factor B	
C ₁	Salicylic Acid @ 1500 ppm (Peanut stage, Marble stage, Egg stage)
C ₂	Salicylic Acid @ 2000 ppm (Peanut stage, Marble stage, Egg stage)
C ₃	KNO ₃ @ 1% (Peanut stage, Marble stage, Egg stage)
C ₄	CPPU @ 3 ppm (Peanut stage, Marble stage, Egg stage)
C ₅	CPPU @ 4 ppm (Peanut stage, Marble stage, Egg stage)
C ₆	n-ATCA 10% and folic acid 0.2% @ 1 ml/l (Pea stage), 1.5 ml/l (Marble stage) and 2 ml/l (Egg stage)
C ₇	Control

Methodology**1. Flowering intensity (%)**

At the time of optimum flowering stage on the experimental tress, the intensity of flowered shoots were counted and calculated by following formula. These values were transformed to arc sine values and considered for statistical analysis.

$$\text{Flowering intensity (\%)} = \frac{(\text{No. of flowering shoots})}{(\text{Total No. of shoots})} \times 100$$

2. Hermaphrodite flowers per panicle

The number of hermaphrodite flowers per panicle was recorded by counting flowers on four tagged panicles selected from each of the four cardinal directions of every tree and the average value was calculated.

3. Male flowers per panicle

At the time of full bloom, male flowers were counted from the previously selected panicle. Average values for these panicles were taken to represent the number of male flowers per panicle.

4. Total numbers of flowers per panicle

The number of total flowers per panicles were obtained by taking sum of male and hermaphrodite flowers.

5. Percent hermaphrodite flowers per panicle

Total number of hermaphrodite flowers appear per panicle were recorded and their percentage in total number of flowers was calculated by following formula.

$$\text{Hermphrodite flower (\%)} = \frac{(\text{Total no of hermaphrodite flowers per panicle})}{(\text{Total no of flowers per panicle})} \times 100$$

6. Percent Male flowers per panicle

Total number of male flowers appear per panicle were counted and their percentage in total number of flower was calculated by following formula.

$$\text{Male flower (\%)} = \frac{(\text{Total no of male flowers per panicle})}{(\text{Total no of flowers per panicle})} \times 100$$

7. Sex ratio (Male: Hermaphrodite Flowers)

The ratio of number of male flowers to the number of hermaphrodite flowers in the panicle was worked out by following formula.

$$\text{Sex Ratio (M: H)} = \frac{(\text{Total no of male flowers per panicle})}{(\text{Total no of Hermaphrodite flowers per panicle})}$$

Statistical Analysis

The collected data were statistically analysed following the method suggested by Panse and Sukhatme (1985) ^[4]. The standard error of mean (S.E.) was calculated and the critical difference (C.D.) at the 5% level of significance was determined wherever the results were found significant. The percentage data were subjected to arc-sine transformation prior to statistical analysis.



Flowering in Rejuvenated Tree of Alphonso Mango



Non Rejuvenated Alphonso Mango Tree



Hermaphrodite/Perfect flower



Male flower

Results

Flowering parameters

Effect of rejuvenation practice in old and senile orchard of Alphonso mango significantly change the flowering parameters of tree that is total number of flowers, number of male flowers, number of hermaphrodite flowers, sex ratio etc.

1. Flowering Intensity (%)

The data revealed that Factor A (Rejuvenation practice)

shows a significant influence on flowering intensity of mango during both years of investigation as well as in pooled analysis. Among the two rejuvenation practice, P₁ recorded significantly higher flowering intensity than non-rejuvenated trees P₂. During 2023-24, P₁ exhibited 62.19% flowering intensity (52.06) compared to 58.89% (50.12) under P₂. Similarly, in 2024-25, P₁ recorded 76.19% (60.79) flowering intensity, whereas P₂ registered 71.96% (58.03).

Table 1: Effect of rejuvenation practice on flowering intensity of mango cv. Alphonso.

	Treatment	Flowering intensity (%)		
		2023-24	2024-25	Pooled
Factor A (P)	P ₁	62.19 (52.06)	76.19 (60.794)	69.19 (56.28)
	P ₂	58.89 (50.12)	71.96 (58.026)	65.43 (53.99)
	Mean	60.54 (51.08)	74.08 (59.39)	67.31 (55.13)
	S.E.±	1.02	0.95	0.76
	C.D. at 5%	2.97	2.75	2.22
Factor B (C)	C ₁	61.04 (51.38)	76.00 (60.666)	68.52 (55.87)
	C ₂	61.19 (51.47)	75.26 (60.172)	68.23 (55.69)
	C ₃	62.43 (52.20)	76.19 (60.794)	69.31 (56.36)
	C ₄	59.81 (50.66)	73.35 (58.920)	66.58 (54.68)
	C ₅	59.53 (50.46)	75.69 (60.459)	67.61 (55.31)
	C ₆	60.40 (51.00)	70.56 (51.140)	65.48 (54.02)
	C ₇	59.39 (50.41)	71.50 (57.734)	65.44 (53.99)
	Mean	60.54 (51.08)	74.08 (59.39)	67.31 (55.13)
	S.E.±	1.91	1.77	1.43
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P ₁ C ₁	61.94 (51.91)	76.88 (61.260)	69.41 (56.42)
	P ₁ C ₂	58.16 (49.70)	76.02 (60.680)	67.09 (54.99)
	P ₁ C ₃	65.23 (53.87)	79.78 (63.278)	72.51 (58.38)
	P ₁ C ₄	60.57 (51.10)	75.15 (60.099)	67.86 (55.46)
	P ₁ C ₅	62.12 (52.01)	79.47 (63.057)	70.79 (57.28)
	P ₁ C ₆	61.14 (51.44)	73.50 (59.017)	67.32 (55.13)
	P ₁ C ₇	66.18 (55.44)	72.55 (58.404)	69.36 (56.39)
	P ₂ C ₁	60.14 (50.85)	75.12 (60.079)	67.63 (55.32)
	P ₂ C ₂	64.23 (53.27)	74.49 (59.664)	69.36 (56.39)
	P ₂ C ₃	59.62 (50.55)	72.60 (58.436)	66.11 (54.40)
	P ₂ C ₄	59.05 (50.21)	71.54 (57.759)	65.30 (53.91)
	P ₂ C ₅	56.94 (48.99)	71.91 (57.995)	64.42 (53.38)
	P ₂ C ₆	59.65 (50.56)	67.62 (55.317)	63.63 (52.91)
	P ₂ C ₇	52.59 (46.48)	70.46 (57.077)	61.53 (51.67)
	Mean	60.54 (51.08)	74.08 (59.39)	67.31 (55.13)
	S.E.±	2.71	2.50	2.02
	C.D. at 5%	NS	NS	NS

(* Figures in parenthesis are the arc sine values)

NS: Non Significance

Factor A (P)	P ₁ -Rejuvenated tree (35 year old)	P ₂ -Non Rejuvenated tree (35 year old)
Factor B (C)	C ₁ -Salicylic Acid @ 1500ppm	C ₅ -CPPU @ 4%
	C ₂ -Salicylic Acid @ 2000ppm	C ₆ -n-ATCA @ 1ml/l (50% flowering), 1.5ml/L (Marble stage), and 2ml/l (Egg stage)
	C ₃ -KNO ₃ @ 1%	C ₇ -Control
	C ₄ -CPPU @ 3%	

The pooled mean also followed the same trend, with P₁ producing 69.19% (56.28) flowering intensity as against 65.43% (53.99) under P₂. Similar findings have been reported by Shinde *et al.* (2003) ^[5], who observed improved flowering and productivity in rejuvenated Alphonso mango orchards due to better light distribution within the canopy. Likewise, Gopu *et al.* (2014) ^[2] reported that canopy management practices significantly enhanced flowering in Alphonso mango by improving canopy microclimate and shoot vigour. Furthermore, Grechi *et al.* (2021) ^[3] demonstrated that pruning intensity and severity influence

flowering processes in mango through modifications in canopy structure and resource allocation. The lower flowering intensity recorded under P₂ may therefore be associated with comparatively less favourable canopy conditions and reduced stimulation of productive shoot growth.

2. Hermaphrodite flowers per panicle

Total number of hermaphrodite flowers per panicle was significantly influenced by rejuvenation practices during both years of study as well as in pooled analysis.

Table 2: Effect of rejuvenation practice on total number of hermaphrodite flowers per panicle of mango cv. Alphonso

	Treatment	Hermaphrodite flowers per panicle		
		2023-24	2024-25	Pooled
Factor A (P)	P ₁	73.86	73.52	73.69
	P ₂	63.71	63.38	63.55
	Mean	68.79	68.45	68.62
	S.E.±	2.33	2.33	2.33
	C.D. at 5%	6.78	6.78	6.78
Factor B (C)	C ₁	60.50	60.17	60.33
	C ₂	62.00	61.67	61.83
	C ₃	73.83	73.50	73.67
	C ₄	66.67	66.33	66.50
	C ₅	74.17	73.83	74.00
	C ₆	78.33	78.00	78.17
	C ₇	66.00	65.67	65.83
	Mean	68.79	68.45	68.62
	S.E.±	4.37	4.37	4.37
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P ₁ C ₁	68.00	67.67	67.83
	P ₁ C ₂	73.67	73.33	73.50
	P ₁ C ₃	76.67	76.33	76.50
	P ₁ C ₄	70.67	70.33	70.50
	P ₁ C ₅	74.33	74.00	74.17
	P ₁ C ₆	81.67	81.33	81.50
	P ₁ C ₇	72.00	71.67	71.83
	P ₂ C ₁	53.00	52.67	52.83
	P ₂ C ₂	50.33	50.00	50.17
	P ₂ C ₃	71.00	70.67	70.83
	P ₂ C ₄	62.67	62.33	62.50
	P ₂ C ₅	74.00	73.67	73.83
	P ₂ C ₆	75.00	74.67	74.83
	P ₂ C ₇	60.00	59.67	59.83
	Mean	68.79	68.45	68.62
	S.E.±	6.17	6.17	6.174
	C.D. at 5%	NS	NS	NS

Among the rejuvenation treatments, P₁ recorded significantly higher numbers of hermaphrodite flowers per panicle compared to P₂. During 2023-24, treatment P₁ produced 73.86 hermaphrodite flowers per panicle, whereas P₂ recorded 63.71 flowers per panicle. A similar trend was observed during 2024-25, wherein P₁ 73.52 flowers per panicle as against 63.38 flowers per panicle under P₂. The pooled mean values further confirmed the superiority of P₁, recording 73.69 hermaphrodite flowers per panicle, while P₂ recorded 63.55 flowers per panicle. The effect of Factor B and the interaction effect on hermaphrodite flower production were found to be non-significant during both years and in pooled analysis. The significantly higher number of hermaphrodite flowers per panicle observed under P₁ may be attributed to the beneficial effects of rejuvenation pruning in improving canopy structure, enhancing light penetration, and promoting vigorous shoot growth. Pruning removes old, senescent, and unproductive branches, thereby stimulating the emergence of healthy shoots with greater physiological efficiency. Improved photosynthetic activity and better translocation of assimilates to developing floral buds may have favoured the formation of a higher proportion of hermaphrodite flowers. Hermaphrodite flowers are the functional flowers responsible for fruit set in mango, and their production is strongly influenced by the nutritional and physiological status of the tree. The enhanced canopy environment under rejuvenated trees likely improved the carbohydrate-to-nitrogen balance and hormonal regulation, leading to increased differentiation of hermaphrodite flowers.

Conversely, the lower number of hermaphrodite flowers recorded under P₂ may be due to comparatively poor canopy illumination and reduced availability of assimilates for reproductive development. The present findings are in accordance with the reports of Shinde *et al.* (2003) ^[5], who observed that rejuvenation pruning in old Alphonso mango orchards improved flowering characteristics by enhancing canopy light interception and shoot vigour. Similar results were reported by Gopu *et al.* (2014) ^[2], who noted that canopy management practices in Alphonso mango improved flowering behaviour and reproductive efficiency. Grechi *et al.* (2021) ^[3] also demonstrated that pruning-induced modifications in canopy architecture influence flowering processes and reproductive development in mango trees.

3. Male flowers per panicle

Number of male flowers per panicle was significantly influenced by rejuvenation practices during both years of study and in the pooled analysis. Among the rejuvenation treatments, P₁ recorded significantly higher numbers of male flowers per panicle than non-rejuvenated tree P₂.

Table 3: Effect of rejuvenation practice on male flowers per panicle of mango cv. Alphonso

	Treatment	Male flowers per panicle		
		2023-24	2024-25	Pooled
Factor A (P)	P ₁	1164.48	1287.10	1225.79
	P ₂	800.05	901.24	850.64
	Mean	982.26	1094.17	1038.21
	S.E.±	48.42	22.92	27.29
	C.D. at 5%	140.75	66.64	79.32
Factor B (C)	C ₁	908.67	1074.33	991.50
	C ₂	906.83	1103.33	1005.08
	C ₃	1097.00	1104.67	1100.83
	C ₄	808.67	1129.67	969.17
	C ₅	1029.00	1087.17	1058.08
	C ₆	1158.00	1148.33	1153.17
	C ₇	967.67	1011.67	989.67
	Mean	982.26	1094.17	1038.21
	S.E.±	90.59	42.89	51.05
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P ₁ C ₁	1151.67	1261.33	1206.50
	P ₁ C ₂	1105.33	1284.67	1195.00
	P ₁ C ₃	1298.33	1373.00	1335.67
	P ₁ C ₄	981.33	1283.00	1132.17
	P ₁ C ₅	1226.67	1231.67	1229.17
	P ₁ C ₆	1293.33	1380.33	1336.83
	P ₁ C ₇	1094.67	1195.67	1145.17
	P ₂ C ₁	665.67	887.33	776.50
	P ₂ C ₂	708.33	922.00	815.17
	P ₂ C ₃	895.67	836.33	866.00
	P ₂ C ₄	636.00	976.33	806.17
	P ₂ C ₅	831.33	942.67	887.00
	P ₂ C ₆	1022.67	916.33	969.50
	P ₂ C ₇	840.67	827.67	834.17
	Mean	982.26	1094.17	1038.21
	S.E.±	128.11	60.65	72.19
	C.D. at 5%	NS	NS	NS

During 2023-24, P₁ produced 1164.48 male flowers per panicle, whereas P₂ recorded 800.05 male flowers per panicle. Similarly, in 2024-25, P₁ registered 1287.10 male flowers per panicle, while P₂ recorded 901.24 male flowers per panicle. The pooled mean also revealed the superiority of P₁ with 1225.79 male flowers per panicle, compared to 850.64 male flowers per panicle under P₂. The effect of Factor B and the interaction effect on male flower

production was found to be non-significant during both years and in pooled analysis. The increase in flower production following rejuvenation pruning is consistent with the findings of Shinde *et al.* (2003) [5], who reported enhanced flowering behaviour and canopy productivity in rejuvenated Alphonso mango orchards. Similar observations were made by Gopu *et al.* (2014) [2], who noted that canopy management practices improved flowering characteristics through better light distribution and physiological activity. Grechi *et al.* (2021) [3] further reported that pruning intensity significantly affects flowering processes in mango by altering canopy structure, source-sink relationships, and assimilate partitioning.

It is noteworthy that although P₁ produced a higher number of male flowers, it also recorded a significantly greater number of hermaphrodite flowers per panicle. Therefore, the increase in male flowers reflects enhanced overall flowering rather than a reduction in reproductive efficiency.

4. Total numbers of flowers per panicle

Table 4: Effect of rejuvenation practice on total numbers of flowers per panicle of mango cv. Alphonso

	Treatment	Total numbers of flowers per panicle		
		2023-24	2024-25	Pooled
Factor A (P)	P ₁	1238.33	1360.62	1299.48
	P ₂	863.76	964.62	914.19
	Mean	1051.05	1162.62	1106.83
	S.E.±	48.57	22.75	27.35
	C.D. at 5%	141.21	66.14	79.51
Factor B (C)	C ₁	969.17	1134.50	1051.83
	C ₂	968.83	1165.00	1066.92
	C ₃	1170.83	1178.17	1174.50
	C ₄	875.33	1196.00	1035.67
	C ₅	1103.17	1161.00	1132.08
	C ₆	1236.33	1226.33	1231.33
	C ₇	1033.67	1077.33	1055.50
	Mean	1051.05	1162.62	1106.83
	S.E.±	90.88	42.57	51.17
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P ₁ C ₁	1219.67	1329.00	1274.33
	P ₁ C ₂	1179.00	1358.00	1268.50
	P ₁ C ₃	1375.00	1449.33	1412.17
	P ₁ C ₄	1052.00	1353.33	1202.67
	P ₁ C ₅	1301.00	1305.67	1303.33
	P ₁ C ₆	1375.00	1461.67	1418.33
	P ₁ C ₇	1166.67	1267.33	1217.00
	P ₂ C ₁	718.67	940.00	829.33
	P ₂ C ₂	758.67	972.00	865.33
	P ₂ C ₃	966.67	907.00	936.83
	P ₂ C ₄	698.67	1038.67	868.67
	P ₂ C ₅	905.33	1016.33	960.83
	P ₂ C ₆	1097.67	991.00	1044.33
	P ₂ C ₇	900.67	887.33	894.00
	Mean	1051.05	1162.62	1106.83
	S.E.±	128.52	42.57	72.37
	C.D. at 5%	NS	NS	NS

Total number of flowers per panicle was significantly influenced by rejuvenation practices during both years of investigation as well as in pooled analysis. Among the rejuvenation treatments, P₁ recorded significantly higher total flowers per panicle than P₂. During 2023-24, treatment P₁ produced 1238.33 flowers per panicle, whereas P₂ recorded 863.76 flowers per panicle. A similar trend was observed during 2024-25, where P₁ registered 1360.62 flowers per panicle compared to 964.62 flowers per panicle

under P₂. The pooled mean values also confirmed the superiority of P₁, which recorded 1299.48 flowers per panicle, while P₂ recorded 914.19 flowers per panicle. The effect of Factor B and the interaction effect factors on total number of flowers per panicle was found to be non-significant during both years and in pooled analysis. The present findings are in close agreement with those reported by Shinde *et al.* (2003) [5], who observed that rejuvenation pruning in Alphonso mango improved flowering and productivity by enhancing canopy light interception and stimulating new shoot growth. Similar observations were reported by Gopu *et al.* (2014) [2], who demonstrated that canopy management practices significantly increased flowering and reproductive performance in Alphonso mango. Furthermore, Grechi *et al.* (2021) [3] reported that pruning intensity and severity strongly influence flowering processes in mango through their effects on canopy structure, resource allocation and floral induction.

5. Percent hermaphrodite flowers

Percentage of hermaphrodite flowers per panicle was significantly influenced by rejuvenation practices during both years of study as well as in pooled analysis.

Table 5: Effect of rejuvenation practice on percent hermaphrodite flowers per panicle of Mango cv. Alphonso

	Treatment	Percent Hermaphrodite flowers per panicle		
		2023-24	2024-25	Pooled
Factor A (P)	P ₁	6.16	5.42	5.79
	P ₂	7.76	6.66	7.06
	Mean	6.96	6.04	6.42
	S.E.±	0.41	0.28	0.24
	C.D. at 5%	1.18	0.83	0.68
Factor B (C)	C ₁	6.64	5.36	6.00
	C ₂	6.75	5.26	5.92
	C ₃	6.81	6.55	6.53
	C ₄	8.20	5.69	6.94
	C ₅	6.96	6.50	6.73
	C ₆	6.60	6.66	6.42
	C ₇	6.76	6.25	6.44
	Mean	6.96	6.04	6.42
	S.E.±	0.76	0.53	0.44
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P ₁ C ₁	5.87	5.09	5.48
	P ₁ C ₂	6.43	5.40	5.91
	P ₁ C ₃	5.62	5.27	5.44
	P ₁ C ₄	7.08	5.20	6.14
	P ₁ C ₅	5.74	5.74	5.74
	P ₁ C ₆	6.00	5.56	5.78
	P ₁ C ₇	6.35	5.65	6.00
	P ₂ C ₁	7.42	5.64	6.53
	P ₂ C ₂	7.07	5.12	5.92
	P ₂ C ₃	8.00	7.84	7.62
	P ₂ C ₄	9.32	6.17	7.75
	P ₂ C ₅	8.17	7.25	7.71
	P ₂ C ₆	7.20	7.75	7.06
	P ₂ C ₇	7.16	6.85	6.87
	Mean	6.96	6.04	6.42
	S.E.±	1.08	0.75	0.62
	C.D. at 5%	NS	NS	NS

Among the rejuvenation treatments, P₂ recorded a significantly higher percentage of hermaphrodite flowers per panicle compared to P₁. During 2023-24, P₂ registered 7.76% hermaphrodite flowers, whereas P₁ recorded 6.16%. Similarly, during 2024-25, P₂ recorded 6.66% hermaphrodite flowers, which was significantly higher than

5.42% observed under P_1 . The pooled analysis also revealed the superiority of P_2 , with 7.06% hermaphrodite flowers per panicle, compared to 5.79% under P_1 . The effects of Factor B and the interaction effect ($A \times B$) were found to be non-significant during both years and in pooled analysis. Although rejuvenation treatment P_2 recorded a significantly higher percentage of hermaphrodite flowers (7.06%) than P_1 (5.79%), P_1 produced a substantially greater number of hermaphrodite flowers per panicle (73.69). Thus, P_1 enhanced overall flowering capacity, whereas P_2 increased the relative proportion of hermaphrodite flowers among the total flowers produced.

6. Percent Male flowers

Percentage of male flowers per panicle was significantly influenced by rejuvenation practices during both years of investigation as well as in pooled analysis.

Table 6: Effect of rejuvenation practice on percent male flowers per panicle of mango cv. Alphonso

	Treatment	Male flowers (%)		
		2023-24	2024-25	Pooled
Factor A (P)	P_1	93.84	94.58	94.21
	P_2	92.50	93.37	92.94
	Mean	93.17	93.98	93.58
	S.E.±	0.31	0.25	0.24
	C.D. at 5%	0.90	0.73	0.68
Factor B (C)	C_1	93.36	94.64	94.00
	C_2	93.43	94.74	94.08
	C_3	93.49	93.45	93.47
	C_4	91.80	94.31	93.06
	C_5	93.04	93.50	93.27
	C_6	93.51	93.65	93.58
	C_7	93.58	93.55	93.56
	Mean	93.17	93.98	93.58
	S.E.±	0.58	0.47	0.44
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P_1C_1	94.13	94.91	94.52
	P_1C_2	93.57	94.60	94.09
	P_1C_3	94.38	94.73	94.56
	P_1C_4	92.92	94.80	93.86
	P_1C_5	94.26	94.26	94.26
	P_1C_6	94.00	94.44	94.22
	P_1C_7	93.65	94.35	94.00
	P_2C_1	92.58	94.36	93.47
	P_2C_2	92.93	94.88	94.08
	P_2C_3	92.00	92.16	92.38
	P_2C_4	90.68	93.83	92.25
	P_2C_5	91.83	92.75	92.29
	P_2C_6	92.80	92.25	92.94
	P_2C_7	92.84	93.15	93.13
	Mean	93.04	93.96	93.58
	S.E.±	1.08	0.75	0.62
	C.D. at 5%	NS	NS	NS

Among the rejuvenation treatments, P_1 recorded a significantly higher percentage of male flowers per panicle compared to P_2 . During 2023-24, P_1 registered 93.84% male flowers, whereas P_2 recorded 92.50%. Similarly, during 2024-25, P_1 recorded 94.58% male flowers, which was significantly higher than 93.37% observed under P_2 . The pooled analysis also showed that P_1 maintained a significantly greater proportion of male flowers (94.21%) compared with P_2 (92.94%). The effects of Factor B and the interaction effect of factors were found non-significant during both years and in pooled analysis. In the present study, P_1 produced significantly higher numbers of total flowers (1299.48 flowers per panicle) and male flowers

(1225.79 flowers per panicle) than P_2 (914.19 and 850.64 flowers per panicle, respectively). Consequently, the proportion of male flowers also increased under P_1 . The higher male flower percentage under rejuvenated trees may be associated with enhanced vegetative vigour and greater assimilate availability, which promoted prolific floral development. Similar observations have been reported in mango, where pruning and canopy management practices increased total flower production, with male flowers constituting the dominant floral type. Conversely, the lower percentage of male flowers recorded under P_2 was accompanied by a relatively higher proportion of hermaphrodite flowers. This suggests that although P_2 produced fewer flowers overall, a greater proportion of the floral buds differentiated into hermaphrodite flowers, resulting in a reduced male-to-hermaphrodite ratio. The findings are consistent with reports by Shinde *et al.* (2003) [5] and Gopu *et al.* (2014) [2], who observed that rejuvenation pruning and canopy management significantly altered flowering behaviour and flower composition in Alphonso mango. Furthermore, Cavalcante (2022) [1] noted that flowering intensity and floral sex expression in mango are influenced by canopy conditions, carbohydrate reserves, hormonal balance and environmental factors, all of which may be modified by pruning practices.

7. Sex ratio (Male: Hermaphrodite flowers)

Sex ratio (M:H) was significantly influenced by rejuvenation practices during both years of study and in pooled analysis. Among the rejuvenation treatments, P_1 recorded a significantly higher sex ratio than P_2 .

Table 7: Effect of rejuvenation practice on sex ratio (M:H) of mango cv. Alphonso

	Treatment	Sex Ratio (Male: Hermaphrodite flowers)		
		2023-24	2024-25	Pooled
Factor A (P)	P_1	15.82	17.60	16.71
	P_2	12.84	15.01	13.89
	Mean	14.33	16.31	15.30
	S.E.±	0.83	0.67	0.54
	C.D. at 5%	2.40	1.96	1.57
Factor B (C)	C_1	14.88	17.90	16.39
	C_2	14.49	18.30	16.43
	C_3	15.28	15.10	15.10
	C_4	12.02	17.48	14.75
	C_5	13.95	14.87	14.41
	C_6	15.03	14.79	15.08
	C_7	14.67	15.70	14.94
	Mean	14.33	16.31	15.30
	S.E.±	1.54	1.26	1.01
	C.D. at 5%	NS	NS	NS
Factor (A X B)	P_1C_1	17.24	18.83	18.04
	P_1C_2	14.95	17.53	16.24
	P_1C_3	17.00	18.04	17.52
	P_1C_4	13.87	18.28	16.08
	P_1C_5	16.45	16.73	16.59
	P_1C_6	15.99	17.03	16.51
	P_1C_7	15.25	16.76	16.00
	P_2C_1	12.52	16.98	14.75
	P_2C_2	14.03	19.07	16.62
	P_2C_3	13.55	12.16	12.68
	P_2C_4	10.18	16.68	13.43
	P_2C_5	11.44	13.00	12.22
	P_2C_6	14.07	12.56	13.65
	P_2C_7	14.09	14.64	13.88
	Mean	14.33	16.31	15.30
	S.E.±	2.18	1.78	1.43
	C.D. at 5%	NS	NS	NS

During 2023-24, the sex ratio under P_1 was 15.82, whereas P_2 recorded 12.84. Similarly, during 2024-25, P_1 registered a sex ratio of 17.60, which was significantly higher than 15.01 observed under P_2 . The pooled analysis further confirmed this trend, with P_1 recording a sex ratio of 16.71 compared to 13.89 under P_2 . The effects of Factor B and the interaction effect ($A \times B$) on sex ratio were found to be non-significant during both years and in pooled analysis. The significantly higher sex ratio (M:H) observed under P_1 was mainly due to the proportionately greater increase in male flower production compared to hermaphrodite flowers. Rejuvenation pruning stimulates vigorous vegetative growth and improves canopy architecture, leading to enhanced floral initiation and overall flower production. Since mango panicles naturally produce a predominance of male flowers, an increase in flowering intensity often results in a greater rise in male flowers than hermaphrodite flowers, thereby increasing the sex ratio. In the present investigation, P_1 produced significantly higher numbers of male flowers (1225.79 flowers per panicle) and hermaphrodite flowers (73.69 flowers per panicle) compared with P_2 (850.64 and 63.55 flowers per panicle, respectively). However, the increase in male flowers was proportionately greater than the increase in hermaphrodite flowers, resulting in a higher sex ratio under P_1 . This finding suggests that rejuvenation pruning enhanced overall floral development but favoured male flower production to a greater extent. The lower sex ratio recorded under P_2 indicates a relatively higher proportion of hermaphrodite flowers in relation to male flowers. Although P_2 produced fewer flowers overall, the reduced dominance of male flowers contributed to a comparatively lower male-to-hermaphrodite ratio. Sex expression in mango is regulated by several physiological factors, including carbohydrate reserves, hormonal balance, nutrient status and environmental conditions. Rejuvenation pruning alters these factors by improving light distribution, photosynthetic efficiency and assimilate partitioning within the canopy. Enhanced vegetative vigour under P_1 may have promoted abundant floral initiation, leading to increased production of male flowers and consequently a higher sex ratio. Similar observations have been reported by Shinde *et al.* (2003) ^[5] and Gopu *et al.* (2014) ^[2], who found that pruning and canopy management practices significantly influenced flowering behaviour and flower composition in mango. Cavalcante (2022) ^[1] further reported that flowering intensity and floral sex expression are strongly affected by canopy microclimate, carbohydrate accumulation and hormonal regulation, which can be modified through rejuvenation practice.

Conclusion

Rejuvenation practice on Alphonso mango orchard improve flowering intensity of tree which results improvement in flowering behaviours, that is number of hermaphrodite flowers, male flowers, sex ratio (M:H) and overall development of fruits.

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