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Influence of sea proximity and soil variations on vegetative growth, flowering and yield of alphonso mango (*Mangifera indica* L.) under coastal belt of Konkan

SG Mahadik, MB Burondkar, VJ Gimhavanekar, PB Vanave, VG Chavan and NV Dalvi

Abstract
The present study was undertaken at three locations *viz*. Karde-Murud (<1 km proximity to sea), Dapoli (10 kms proximity to sea) and Wakavali (25 kms proximity to sea) Tal. Dapoli, Dist. Ratnagiri (Maharashtra), during the year 2017-2018 and 2018- 19.The various vegetative, flowering and fruiting attributes at various locations were examined during the course of experiment. The days required for harvesting from induction of vegetative flush and days required for maturity at the time of fruit development were also examined. Mango orchards close to sea and grown on red lateritic rocks established their supremacy over other two sea proximities and soil variations owing to lowest soil moisture depletion (by 29.78%) at post monsoon stage which laid to early induction of vegetative flush (by 22) days followed early (by 13 days) and profuse flowering (by 47%) and fruiting (by 74%), leading to higher fruit yield per tree (by 57%) with better post-harvest quality of fruits than the orchards at 25 kms proximity to sea grown on plain land with good soil depth. The shorter maturation period by 19 days was observed for fruits at location nearest to sea than other locations.

Keywords: alphonso mango, sea proximity, soil types, soil moisture, flowering, fruiting, yield

Introduction
In India, mango is most popular and choicest of all indigenous fruits amongst the millions of people hence, it is considered as a “King of Fruit” and contributes about 41 per cent of the world production. The Konkan region of Maharashtra (India) is emerging as one of the biggest mango growing belts in India which accounts only one per cent of total geographical area of country, occupies about 8 per cent of total area (1.83 lakh ha) under mango in the country. However, the production is only 4 lakh tons with a productivity of about 2.5 tons ha-1. This region comprises two agro-climatic zones (North and south coast zones) is a long strip of 720 kms, stretching from north of Goa to south of Gujarat along the west coast of India, Topographically, a region is distinctly different from other parts of country, Hilly terrain, well drain, slightly acidic in nature, red lateritic soil with assured annual rainfall ranging from 3000-3500mm during June-September,
followed by bright sunny days period of over seven months from October to May, mild winter (December-February) during flowering and mild summer (March-May) during fruit development, render this region is one of the best region in the world for commercial cultivation of Mango and known worldwide as homeland for commercial cultivation of world famous Indian mango Cv, Alphonso, locally known as hapus.
This variety is majorly grown in Ratnagiri and Sindhudurga districts of the Maharashtra state. It is also noticed that the mango orchards under different locations in this region differ remarkably in the number of days taken for maturity and the mango grown on red lateritic rocky hills mature much earlier than those commonly grown on plain areas in the region. It is presumed that prevailing diurnal temperatures during fruit maturation may play contributory role. The altitude and topographical variation can bring about changes which significantly affect plant growth and quality of mango. Thus there is very considerable climatic variability in both macro and micro scale. The growth, yield and quality of Alphonso mango seems to be varying according to the coastal low land and upland. The phenophase of mango is governed by several (edaphic, agro climatic and biochemical) factors and alteration in the physiological process helps to induce reproductive phase. Normally, after ceasing of monsoon (rain), the soil moisture is gradually declined and the phenology of the mango tree is governed by the soil moisture status.

Availability of soil moisture and nutrients at critical stages of plant growth enhances the crop productivity. The mild soil moisture stress is regarded as one of the soil factors which favour the early induction of flowering differentiation in mango (Levitt *et al*., 1980) [6]. Water stress condition is generally required for the induction of flowering. It is common observation in Konkan that mango trees on sloppy hills and mountains and rocky areas; which expose to early withdrawal of soil moisture exhibits early flowering as compare to those mango trees planted on low lying areas with high residual soil moisture (Burondkar *et al*., 2018) [3].

It is believed that the vegetative growth, flowering and fruiting behaviour and fruit quality is highly influenced by proximity to sea and soil type. Hence, the present investigation was aimed to elicit information on the influence of sea proximity and soil variations on growth and yield of Alphonso mango.

Material and Methods

The present investigation was conducted at three locations *viz*. Karde/Murud (<1 km proximity to sea), Dapoli (10 kms proximity to sea) and Wakavali (25 kms proximity to sea) Tal. Dapoli, Dist. Ratnagiri (Maharashtra), during the year 2017-2018 and 2018- 19.The experiment was laid down in factorial randomized block design. The experimental details were as follows,

A. Main treatments: Proximity to sea (km) (3)

L1-<1 km proximity to sea

L2- 10 kms proximity to sea

L3- 25 kms proximity to sea

B. Sub -treatments: Soil types (3)

S1 –Plain land with good soil depth (more than one meter)

S2 - Hilly terrain with good soil depth (more than one meter)

S3 – Hilly terrain with red lateritic rocks

Treatment combinations

Sr. No.	Treatment combinations	Treatment details
1	L1S1	<1km proximity to sea (N17o45.728’, E073o07.198’, Altitude-25 M MSL) with Alphonso mango plantation on plain land with good soil depth (more than 1 meter).
2	L1S2	<1km proximity to sea (N17o46.712’, E073o07.557’, Altitude-55 M MSL) with Alphonso mango plantation on hilly terrain with good soil depth (more than 1 meter).
3	L1S3	<1km proximity to sea (N17o44.375’, E073o08.206’, Altitude-177 M MSL) with Alphonso mango plantation on hilly terrain with red lateritic rocks.
4	L2S1	10 kms proximity to sea (N17o44.922’, E073o11.112’, Altitude-171 M MSL) with Alphonso mango plantation on plain land with good soil depth (more than 1 meter).
5	L2S2	10 kms proximity to sea (N17o46.054’, E073o10.531’, Altitude-196 M MSL) with Alphonso mango plantation on hilly terrain with good soil depth (more than 1 meter).
6	L2S3	10 kms proximity to sea (N 17o44.134’, E073o09.908’, Altitude-233 M MSL) with Alphonso mango plantation on hilly terrain with lateritic rocks.
7	L3S1	25 kms proximity to sea (N 17o44.064’, E073o16.991’, Altitude-179 M MSL) with Alphonso mango plantation on plain land with good soil depth (more than 1 meter).
8	L3S2	25 kms proximity to sea (N 17o43.933’, E073o16.892’, Altitude-209 M MSL) with Alphonso mango plantation on hilly terrain with good soil depth (more than 1 meter).
9	L3S3	25 kms proximity to sea (N 17o43.445’, E073o16.700’, Altitude-214 M MSL) with Alphonso mango plantation on hilly terrain with lateritic rocks.

The Alphonso mango trees of 20 to 30 years old having uniform size and canopy were selected for this experiment. Recommended cultural practices and plant protection measures were followed as per schedule formulated by Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli in order to protect blossom and fruit set from major pest (Mango hopper), diseases (Powdery mildew) and parasite like Loranthus. The recommended dose of FYM and N, P, K were applied in month of June as per recommended schedule.

Soil moisture was estimated at four different growth stages *viz* post monsoon, flowering, fruiting and post-harvest stage by adopting oven dry method as given by Standards Association of Australia. AS 1289 B1.1-1977.

For recording various observations on each experimental tree at various locations, 25 panicles of uniform size and age were selected randomly from all directions and tagged to record the morphological observations.

The date of vegetative flush was recorded when bud started to break, by selecting 25 shoots from each tree. One hundred shoots were marked randomly on each tree for recording observations in respect of per cent vegetative flush per tree. The date of induction of flowering was recorded when the reproductive bud was started to break from shoot. Per cent flowering was recorded based on 100 marked shoots on each tree per flush. Number of fruit set at pea nut stage was counted on selected 25 panicles in all directions and average fruit set was calculated. Fruit retention at harvesting stage of the fruit was counted and recorded on the same selected 25 panicles in all direction and fruit retention per panicle at harvest was calculated. The yield per tree was calculated by multiplying umber of fruits per tree with average fruit size and expressed as kg per tree. Harvested fruits were observed for individual fruit size in terms of weight (g). Number of days taken for maturity was estimated from the date of vegetative flush to the date of harvest of fruits at optimum maturity.

Results and Discussion

The soil moisture was observed to be significantly influenced by sea proximities and soil variations. The soil moisture was found to be decreased gradually with advancement of stages. Among various treatments; the early and more depletion of soil moisture took place at location nearest to sea and in red lateritic rocky soil than other locations and soil types.

The present study indicated that all the vegetative growth parameters *viz*., time of vegetative flush induction, and percent vegetative flush were significantly influenced by different sea proximities and soil variations.

Irrespective of soil variations, it was observed that there was a gradual increase in the days required for induction of vegetative flush with increase in the proximity to sea. An early (21.5 days) induction of vegetative flush was observed at <1 km proximity to sea which was 23.5 days earlier than 25 kms proximity to sea (45 days). Induction of vegetative flush was also significantly influenced by soil variations. Irrespective of sea proximities, an early (28 days) induction of vegetative flush was observed in hilly terrain with lateritic rocks which was 5 days earlier than the orchard grown on plain land having good soil depth (33 days). Among the interactions, the earliest induction of vegetative flush by 22 days was observed at proximity <1 km to sea with hilly terrain with lateritic rocks (17.8 days) over 25 kms proximity to sea with plain land having good soil depth(49.7 days).

Regarding the per cent vegetative flush, the location, L1 (<1 km from sea) and soil type S3 (hilly terrain with red lateritic rocks) showed lower (44.89% and 47.56%) reduction in vegetative flush by 21% and 14% respectively than the location, 25 kms proximity to sea (56.67%) and plain land with good soil depth(55.22%). Whereas, the lowest (38.67%) reduction in vegetative flush by 34.46% over L3S1 (59.00%) was observed in an interaction, L1S3 (<1 km from sea with hilly terrain with red lateritic rocks). Similar growth behaviour in terms of emergence of vegetative flushes were earlier reported by Patil (1999) [12] and Malshe and Diwate (2015) [9] and Burondkar, 2018) [3]. This could be attributed to variations in soil plant and atmospheric water relations prevailing at different locations under soils as reported by Tahir *et al*., 2003 and Luvaha., 2008) [16].

Irrespective of soil variations, it was observed that there was a gradual delay in induction of flowering with increase in the proximity to sea. An earlier (59.11 days)

induction of flowering was observed at <1 km proximity to sea by 3 days from induction of vegetative flush than the location 25 kms proximity to sea (62.44 days). Induction of flowering was also significantly influenced by soil variations. Irrespective of sea proximities, an early (55.06 days) induction of flowering was observed in hilly terrain with lateritic rocks by 10 days as compared with the plain land having good soil depth

(65.28 days). Among the interactions, the earliest (52.83 days) induction of flowering was observed at proximity <1 km to sea with hilly terrain with lateritic rocks by 14 days over an interaction 10 kms proximity to sea with plain land having good soil depth(67 days).

The per cent flowering was comparatively lowered from the locations L1 (< 1 km proximity to sea) to L3 (25 kms proximity to sea) which ranged from 69.67% to 60.39% respectively. About 15.37% maximum flowering was observed at the location nearest to sea i.e.L1 (< 1 km proximity to sea) than L3 (25 kms proximity to sea). The increasing trend of percent flowering was observed from S1 (plain land with good soil depth) to S3 (hilly terrain with red lateritic rocks) ranged from 57.94% to 73.44%.About 27% maximum flowering was recorded in S3 (hilly terrain with red lateritic rocks) than S1 (plain land with good soil depth). The interaction L2S3 (10 kms proximity to sea with hilly terrain with lateritic rocks) putforth highest (77.00%) per cent flowering followed by L1S3 (<1 km proximity to sea with hilly terrain with red lateritic rocks) which was 55% and 47% more than the minimum recorded in L3S1 (25 kms proximity to sea with hilly terrain with lateritic rocks) interaction respectively.

In present investigation, induction of early flowering by 3 days and profuse flowering (73.67%) at the location nearest to sea with hilly terrain having lateritic rocks could be attributed to early exposure to soil moisture stress. The similar response of mango for the flowering is also reported by Gunjate *et al*. (1977) [4], Nunez-Elisea and Devenport, 1994, Shinde *et al*., (2005) [15] and Malshe *et al*. (2016) [10]. in mango, Koshita and Takahara (2004) in citrus.

The fruit retention at pea and harvest stages was significantly influenced by sea proximities and soil variations and their interactions. Maximum fruit retention (9%) was putforth at L1 location i.e. <1km proximity to sea than the location (L3- 25 kms proximity to sea) at both pea and harvest stage. Similarly, the about and 25% more fruit retention at pea and 11% at harvest stage was observed in S1 i.e. plain land with good soil depth than S3 i.e. hilly terrain with red lateritic rocks. As regards to the interactions, about 37% maximum fruit setting was observed in L2S1 than in L2S3 at pea stage and 17% more fruit retention in L1S1 than L3S3 at harvest stage. The higher fruit retention at the location close to sea (<1km proximity to sea) might be due to higher hermaphrodite flowers and congenial microclimate (low temperature and high humidity) near seashore during fruit development stage (Salvi *et al*., 2012). The highest fruit retention in S1 i.e. plain land with good soil depth than S3 i.e. hilly terrain with red lateritic rocks could be due to high soil moisture retention in soil and high leaf water potential in leaf. The lowest fruit retention in hilly terrain with red lateritic rocky land might be due to high water stress and high temperature which induce fruit drop than rest of the locations. The extent of fruit retention could be attributed to the favourable climatic conditions, sufficient nutrition and even moisture available in the soil. The intensity of fruit drop was observed more at Mulde and mango orchards on lateritic rocks near Deogad and Malwan as it was significantly influenced by increase in maximum temperature (Salvi *et al.*, 2013) [14]. Similar findings were recorded by Lu and Chacko, 1997) [7].

The present study revealed that among the sea proximities, trees which were grown at <1 km proximity to sea(L1) recorded significantly highest number of fruits (178.61/tree) which were about 37% more than the trees grown at 25 kms proximity to sea (L3) location. With regards to soil variation, it is observed that the trees planted on hilly terrain with red lateritic rocky soil recorded about 24% higher number of fruits (173.17/tree) than trees planted on plain land with good soil depth (140.06/tree). As far as interactions between sea proximities and soil variations are concerned, the trees planted on hilly terrain with red lateritic soil at location less than 1 km from sea (L1S3) recorded 74% maximum number of fruits (197.33/tree) than number of fruits was recorded in L3S1 (113.17/tree).The higher number of fruits at location nearest to sea and soil site, hilly terrain with red lateritic rocks may attributed to maximum per cent flowering and fruit retention.

The weight of fruit (252.34 g) harvested from the location 25 kms away from the sea (L3) was recorded highest by 5.77% over the location less than 1 km from sea (238.57) and by 3.44% over 10 kms away from the sea (243.95 g). The trees planted at plain land with good soil depth showed significantly highest fruit weight (250.85 g) by1.54% over other hilly terrain with good soil depth (247.03g) and 5.84% hilly terrain with lateritic rocks (236.99g).The maximum fruit weight at location 25 kms proximity to sea and the soil site plain land with good soil depth may attributed to high soil moisture content during fruit development.

Among the various sea proximities, the location<1 km proximity to sea recorded 30% more yield (42.59 kg/tree) than the location 25 kms proximity to sea (32.74 kg/tree). Similarly, among soil variations, trees planted on hilly terrain with red lateritic soil showed 17% higher yield (40.97kg/tree) than plain land with good soil depth (34.95 kg/tree). Among various interactions, the highest yield per tree (46.15 kg) was recorded at location nearest to sea (<1km proximity to sea) having red lateritic rocky soil which was 56.65% more than the lowest yield recorded at 25 kms proximity to sea having plain land with good soil depth.. The increase in yield may well be associated with improved values of intensity of flowering, fruit set and number of fruits retained per tree in the period of experimentation. The significant increase in yield due to increase in number of fruits per tree was well documented by Burondkar and Chetti (2005) [2], Kurian and Iyer (1993) [5], Leal *et al*. (1997) [6], Pujari and Ram (1999), and Malshe *et al*. (2016) [10].

As regards to the days required for maturity from vegetative flush to harvesting are significantly influenced by sea proximities, soil variations and their interactions. The minimum days (185.44 days) required for harvesting were recorded at location nearest to sea i.e. less than 1 km proximity to sea which was 5 days earlier than 25 kms proximity to sea (190.67 days). Among the different soil variations, the hilly terrain with rocky soil recorded minimum (177.56 days) days for harvesting from induction of vegetative flush which was about 21 days earlier than plain land with good soil depth where 198.11days were required for harvesting. An interaction between sea proximity and soil variation, earlier harvesting was carried out by 24.5 days at 10 kms from sea and hilly terrain with rocky soil (L2S3) followed by 24 days at less than one km to sea with hilly terrain with rocky soil (L1S3) than the late harvesting at 25 kms proximity to sea with plain land with good soil depth. The early fruit maturity may be attributed due to the influence of water stress due to more depletion of soil moisture.

The early fruit maturity from fruit setting at different locations depends upon the diurnal temperature prevailed at location at fruit maturation. In the present investigation, it was noticed that Alphonso mango fruits were matured 19 days earlier at location less than one km proximity to sea followed by 17 days at location 25 kms proximity to sea than the location 10 kms proximity to sea. The shorter maturation period observed for fruits at location nearest to sea could be attributed to rapid fulfilment of heat units which occurred at the rate of 1.77 more heat units (degree days) per day followed by 1.17 more heat units at 25 kms proximity to sea than 10 kms proximity to sea (Table 6). The similar results in mango are also reported by Burondkar, *et al*. (2000) [1] at Vengurla location and on typical lateritic rocky slopes of Deogad owing to heat unit generations at different locations. The results are in conformity with Malshe and Diwate (2015) [9]. Soil moisture showed significantly positive correlation with days required for vegetative flush induction, days required for induction of flowering and harvesting and fruit retention at pea stage while it exhibited significantly negative relationship with per cent flowering, fruit retention at harvest stage, number of fruits per tree and yield per tree.

Table 1: Influence of sea proximity, soil variations and their interactions on soil moisture content (Per cent) at various stages of growth of Alphonso mango under coastal belt of Konkan region (pooled)

	Post Monsoon	Flowering	Fruiting	Post Harvest
Location				
L1	23.27	16.04	13.07	9.07
L2	23.09	18.21	15.38	9.51
L3	24.98	19.85	15.72	10.88
S.E.	0.14	0.18	0.17	0.2
C.D.	0.43	0.54	0.5	0.61
Soil Variation				
S1	25.95	20.04	16.78	11.7
S2	24.85	19.09	15.71	9.92
S3	20.54	14.96	11.68	7.84
S.E.	0.14	0.18	0.17	0.2
C.D.	0.43	0.54	0.5	0.61
Interaction				
L1S1	24.68	17.13	14.18	10.7
L1S2	25.4	18.69	14.73	9.18
L1S3	19.74	12.31	10.29	7.33
L2S1	25.06	21.05	17.81	10.97
L2S2	23.68	18.76	16.52	9.98
L2S3	20.53	14.81	11.8	7.57
L3S1	28.11	21.94	18.35	13.43
L3S2	25.48	19.83	15.87	10.58
L3S3	21.35	17.77	12.93	8.63
S.E.	0.25	0.31	0.29	0.35
C.D.	0.75	0.94	0.87	NS

Table 2: Influence of sea proximity and soil variations on date of vegetative flush induction in Alphonso mango

Sr. No.	Treatments	Date of vegetative flush induction	
		2017-18	2018-19
1	L1S1	2nd week of October (10 to 16.10.2017)	4th week of September (29.09 to 04.10.2018)
2	L1S2	1st week of October (03 to 07.10.2017)	2nd week of October (12 to 18.10.2018)
3	L1S3	1st week of October (01 to 03.10.2017)	4th week of September (30 Sept.to 06.10.2018)
4	L2S1	2nd week of October (10 to 16.10.2017	3rd week of October (15to 17.10.2018)
5	L2S2	2nd week of October (10 to 16.10.2017)	2nd week of October (13 to 17.10.2018)
6	L2S3	2nd week of October (8 to 11.10.2017)	2nd week of October (11 to 17.10.2018)
7	L3S1	2nd week of November (8 to 13.11.2017)	1st week of November (29.10.2018 to 05.11.2018)

8	L3S2	1st week of November (1 to 7.11.2017)	4th week of October (20.10.18 to 02.11.2018)
9	L3S3	4th week of October (26 to 31.10.2017)	3rd week of October (19 to 26.10.2018)

Table 3: Influence of sea proximity and soil variations on date of induction of flowering of Alphonso mango

Sr. No.	Treatments	Date of induction of flowering	
		2017-18	2018-19
1	L1S1	2nd week of December (02 to 05.12.2017)	1st week of December (02 to 05.12.2018)
2	L1S2	1st week of December (03 to 8.12.2017)	2nd week of December (12 to 18.12.2018)
3	L1S3	3rd week of November (18 to 22.11.2017)	4th week of November (25to 28.11.2018)
4	L2S1	3rd week of December (15 to 21.12.2017)	3rd week of December (20to 26.12.2018)
5	L2S2	2nd week of December (09 to 14.12.2017)	2nd week of December (10 to 17.12.2018)
6	L2S3	1st week of December (28.11 to 04.12.2017)	1st week of December (02.12 to 08.12.2018)
7	L3S1	2nd week of January (13to 18.01.2018)	2ndweek of January (06 to 14.01.2019)
8	L3S2	1st week of January (4 to 10.01.2018)	4th week of December (22.12.18 to 04.01.2019)
9	L3S3	4th week of December (23 to 27.12.2017)	3rd week of December (13 to 26.12.2018)

Table 4: Influence of sea proximity and soil variations on induction Vegetative flush (From 15thsept.) and flowering and fruit retention at pea nut stage and fruit retention at harvest stage in Alphonso mango under coastal belt of Konkan region

	Days required for Vegetative flush induction (From 15thsept.)	Per cent Vegetative Flush	Days required for Flowering (from induction of vegetative flush)	Per cent Flowering	Fruit retention at pea nut stage/panicle	Fruit retention at harvest stage/panicle
Location						
L1	21.5	44.89	59.11	69.67	17.56	0.73
L2	27.3	53.94	60.28	67	17.44	0.7
L3	45	56.67	62.44	60.39	16.11	0.67
S.E.	0.23	0.28	0.66	0.6	0.16	0.03
C.D.	0.7	0.85	1.98	1.81	0.48	0.1
Soil Variation						
S1	33.1	55.22	65.28	57.94	19.11	0.73
S2	32.6	52.72	61.5	65.67	16.72	0.71
S3	28	47.56	55.06	73.44	15.28	0.66
S.E.	0.23	0.28	0.66	0.6	0.16	0.03
C.D.	0.7	0.85	1.98	1.81	0.48	0.1
Interaction						
L1S1	21.8	85	63.33	65.17	18.5	0.76
L1S2	24.8	45.5	61.17	70.17	18.17	0.75
L1S3	17.8	38.67	52.83	73.67	16	0.67
L2S1	237.9	56.17	67	58.67	20.67	0.73
L2S2	28	55.83	59.67	65.33	17	0.72
L2S3	25.8	49.83	54.17	77	14.67	0.65
L3S1	49.7	59	65.5	50	18.17	0.69
L3S2	44.9	56.83	63.67	61.5	15	0.67
L3S3	40.4	54.17	58.17	69.67	15.17	0.65
S.E.	0.4	0.49	1.15	1.05	0.28	0.01
C.D.	1.21	1.47	NS	3.14	0.83	0.03

Table 5: Influence of sea proximity, soil variations and their interactions on No. of fruits/Tree and Yield/Tree (kg) of Alphonso mango under coastal belt of Konkan region

	No. of fruits/Tree	Average fruit weight (g)	Yield/Tree (kg)	Days required for Harvesting
Location				
L1	178.61	238.57	42.59	185.44
L2	157.78	243.95	38.42	189.67
L3	130.33	252.34	32.74	190.67
S.E.	1.15	1.22	0.36	0.39
C.D.	3.45	3.66	1.19	1.17
Soil Variation				
S1	140.06	250.85	34.95	198.11
S2	153.5	247.03	37.83	190.11
S3	173.17	236.99	40.97	177.56
S.E.	1.15	1.22	0.36	0.39
C.D.	3.45	3.66	1.19	1.17
Interaction				
L1S1	160.17	241.71	38.71	193.83
L1S2	178.33	240.39	42.93	186.17
L1S3	197.33	233.61	46.15	176.33
L2S1	146.83	249.78	36.7	200.33
L2S2	152	248	37.69	192.83

L2S3	174.5	234.08	40.87	175.83
L3S1	113.17	261.07	29.46	200.17
L3S2	130.17	252.7	32.85	191.33
L3S3	147.67	243.27	35.9	180.5
S.E.	1.99	2.11	0.69	0.68
C.D.	5.97	NS	NS	2.03

Table 6: Comparative data of fruit maturation period and heat units required for the maturation of Alphonso mango at different proximities to sea

Sr. No.	Locations(Proximity to sea)	Duration from fruit setting to maturity (days)	Difference in duration at three proximities	Total heat units (Degree days)	Mean heat units (Degree days)	Difference in mean heat units (Degree days)
1	L1 (<1 km proximity to sea)	79	19	733	9.28	1.78
2	L2 (10 kms proximity to sea)	98	-	732	7.50	-
3	L3 (25 kms proximity to sea)	85	13	737	8.67	1.17
	SE	0.49	-	4.09	-	-
	CD at 5%	1.48	-	NS	-	-

Table 7: Correlation co-efficient value between morphological, yield parameters and soil moisture

	Days required for veg flush induction	Days required for induction of flowering	% vegetative flush	% Flowering	Days required (from veg-to harvesting	Fruit retention at peanut stage	Fruit retention at harvest stage	No.of fruits/ tree	Yield/ tree	Soil moisture
Days required for veg flush induction	1.000									
Days required for induction of flowering	0.441	1.000								
% vegetative flush	0.652**	0.160	1.000							
% Flowering	-0.631**	-0.770**	-0.259	1.000						
Days required (from veg-to harvesting	0.395	0.868**	0.180	-0.875**	1.000					
Fruit retention at peanut stage	-0.186	0.559*	-0.335	-0.467	1.000					-0.186
Fruit retention at harvest stage	-0.570*	-0.312	-0.067	0.356	0.096	1.000				-0.570*
No. of fruits/tree	-0.780**	-0.204	-0.896**	0.389	0.332	0.115	1.000			-0.780**
Yield/tree	-0.803**	-0.598**	-0.651**	0.701**	-0.013	0.493*	0.697**	1.000		-0.803**
Soil Moisture	0.664**	0.858**	0.359	-0.814**	0.437	-0.413	-0.403	-0.750**	1.000	0.664**

(*indicates significance at 5 per cent levels; **indicates significance at 1 per cent levels)

Conclusion

Unarguably, mango orchards close to sea coasts and grown on red lateritic rocky soil established their supremacy over other two sea proximities and soil variations, as they exhibited induction of early and profuse flowering and fruiting, leading to higher fruit yield per tree with better post-harvest quality of fruits. Mango trees in orchards close to sea coasts and grown on red lateritic rocky soil get natural advantage of getting exposed to early mild soil water stress required as stimulus for induction of early and profuse flowering, leading to early harvesting of fruits in the season.

References

1. Burondkar MM, Bhingarde RT, Kore VN, Powar AG. Estimation of heat units as maturity indices for different mango varieties in konkan region of Maharashtra. Acta Hortic 2000;509(33):297-300.
2. Burondkar MM, Chetti MB. Influence of plant growth regulators, polyamine and nutrients on post-flowering physiological behaviour in relation to yield and quality in Alphonso mango (*Mangifera indica* L.). Ph. D. Thesis, University of Agricultural Sciences Dharwad 2005.
3. Burondkar MM, Kulkarni MM, Ambavane AR, Mahadik SG, Mane AV, Kelkar KD *et al*. Low productivity of Alphonso mango in konkan: Environmental and physiological reasons. Advances in mango production technology Book published by Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli 2018, 241-255.
4. Gunjate RT, Rajput JC, Limaye VP. Fruit bud differentiation in Alphonso mango (*Mangifera indica* L.) under Konkan conditions. Journal of Maharashtra Agriculture University 1977;2(2):134-138. Hormone content of satsuma mandarin (*Citrus unshiu* Marc.) Sci. Hort 2004;99:301-307.
5. Kurien RM, Iyer CPA. Chemical regulation of tree size in mango (*M. indica* L.) cv. Alphonso, II Effect of growth retardant on flowering and fruit set. Journal of Horticultural Sciences 1993;68(3):355-360.
6. Leal F, Avilan L, Sergent EF. The Venezuelan Mango industry. Acta Horticulturae. Levitt, J Response of Plants to Environmental Stresses Academic Press, New York 1980; 2:489-530.
7. Lu P, Chacko EK. Effect of water stress on mango flowering in low latitude tropics of northern Australia. CSIRO Plant Industry 1997.
8. Luvaha E, Netando GW, Ouma. Effect of Water Deficit on the Physiological and Morphological Characteristics of Mango (*Mangifera indica*) Rootstock Seedlings. American Journal of Plant Physiology 2008;3:1-15.
9. Malshe KV, Diwate SA. Assessment of vegetative flush and flowering in different mango (*Mangifera indica* L.) cultivars under hard lateritic rocky conditions. Annals of Biology 2015;(31):284-286.

10. Malshe KV, Salvi BR, Khandekar RG. Studies on flowering behaviour of Alphonso mango (*Mangifera indica* L.) under hard lateritic rocky conditions. Annals of Plant Physiology 2016;(30):28-31.
11. Nunez-Elisea R, Davenport TL. Effect of leaf age, duration of cool temperature treatment and photoperiod on bud dormancy release and floral initiation in mango. Scientia Hort 1995;62:63-73.
12. Patil DM. Phenological studies in some mango (*Mangifera indica* L.) Cvs. viz., Alphonso, Ratna, Kesar, Amrapali. M.Sc. (Agri.) Thesis submitted to Konkan Krishi Vidyapeeth, Dapoli Dist. Ratnagiri 1999.
13. Pujari KH, Ram S. Development of corn root curvature bioassay for estimation of paclobutrazol residues in mango. VIth International mango Symposium, Pattaya, Thailand; 1999. Sustainable management practices under climate change scenario 2012.
14. Salvi BR, Damodar VP, Mahaldar SR, Munj AY. Flowering phenology and productivity of Mango Cv. Alphonso. Ann. Plant phyhsiology 2013;27(2):73-76.
15. Shinde AK, Patil BP, Godse SK, Jadhav BB, Kandalkar MP. Weather relations in floral sex expression in Alphanso mango J Agrometeriology 2005;7(1):135-139.
16. Tahir FM, Ibrahim M, Hamid Kamran. Effect of Drought Stress on Vegetative and Reproductive Growth Behaviour of Mango (*Mangifera indica* L.) Asian Journal of Plant Sciences 2003;2:116-118.