HYBRIDS

OIL PALM

EVALUATION OF OIL PALM HYBRIDS FOR PRECOCITY IN KONKAN CONDITIONS OF MAHARASHTRA

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ABSTRACT

Oil palm hybrids of Dura X Pisifera, were evaluated under Konkan conditions of Maharashtra for three years from 2013 to 2015. Significant variation for number of leaves, weight of bunch and yield of fresh fruit bunch (FFB) was recorded. Among the hybrids NRCOP-4 and NRCOP-5 registered minimum height (2.4 m) during the year 2015 and maximum sex ratio above 50 percent. The average sex ratio for population was 49.2 per cent. The hybrid NRCOP-2, NRCOP-8 and NRCOP-5 had more number of female flowers than male flowers. There was significant variation among hybrids for leaf production and for FFB yield. The hybrid NRCOP-2 recorded highest yield during 2015 (12.8 t/ha^{-1}) and average of 7.3 tonnes per hectare over the years. Among the remaining hybrids NRCOP-1 (9.7 t/ha^{-1}), NRCOP-8 (9.6 t/ha^{-1}) and NRCOP-9 (9.5 t/ha^{-1}) were also found promising for FFB yield during 2015. Three years average performance exhibited that NRCOP-2 was most promising hybrid followed by NRCOP-8, NRCOP-9, NRCOP-6 and NRCOP-7 under Konkan agro-climatic conditions of Maharashtra.

KEY WORDS: **Fresh fruit bunch (FFB), Oil palm, Sex ratio, Yield.**

Introduction

Oil palm is rated as the largest edible oil yielding crop (4-6 t oil/ha) and has become the most economic crop in global vegetable oil market. It is the most important source to meet the challenges of edible oil crisis arising due to ever increasing population. It is an eco-friendly crop, environmentally sustainable and plays a vital role in the food, industry and bio-fuel sectors. In India a total of about one million hectares have been identified as potential areas suitable for its cultivation (Chadha, 2006). At present, it is being grown in an area of about 2.62 lakh ha with productivity levels reaching as high as 30-35 t FFB/ha/year (Anonymous, 2015a). Area under oil palm is steadily increasing through different schemes of Govt. of India and hence demand for quality planting material which is prerequisite for enhancing productivity is increased. Systematic programmes for evolving high yielding oil palm hybrids have been initiated about five decades back (Obasola *et al.*, 1976). Several hybrids between Dura and Pisifera have been derived and are under testing in India and other countries. Identification of a hybrid having consistency in potentially high yield with least sensitivity to unfavourable environmental conditions and with ability to exhibit maximum potential under favourable conditions are the basic requirements for area expansion of hybrids of this crop.

In this context the present investigation was conducted where ten Dura X Pisifera hybrids developed by IIOPR, Pedavegi were evaluated for their performance on the basis of height, girth, sex ratio and yield during early age tested under Konkan agro-climatic condition of Maharashtra.

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Table 1

Growth and flowering performance of different oil palm hybrids

Hybrid	Height (m) 2015	Girth (m) 2015	No. of leaves/ palm		No. of male inflorescences/ palm		No. of female inflorescences/ palm		Sex ratio %	
			2015	Pooled mean (2013-15)	2015	Pooled mean (2013-15)	2015	Pooled mean (2013-15)	2015	Pooled mean (2013-15)
NRCOP-1	2.8	2.8	27.0	23.0	7.2	4.9	5.4	3.8	42.1	42.7
NRCOP-2	3.0	2.7	25.5	21.9	5.1	2.8	8.0	5.5	61.1	59.1
NRCOP-3	2.7	2.6	27.0	21.7	7.1	4.5	5.7	4.4	44.6	49.1
NRCOP-4	2.4	2.4	24.2	20.9	6.7	4.1	5.8	4.2	46.4	50.2
NRCOP-5	2.4	2.7	25.2	20.9	5.4	3.8	6.2	4.1	52.0	51.1
NRCOP-6	2.7	2.6	26.7	22.7	6.0	4.3	6.3	4.7	48.9	49.2
NRCOP-7	2.6	2.7	28.1	23.1	6.6	4.3	5.2	4.9	43.7	49.9
NRCOP-8	2.8	2.4	23.7	20.3	5.7	4.0	5.6	4.5	45.9	51.5
NRCOP-9	3.1	2.8	25.5	22.1	6.8	4.7	5.9	4.4	45.9	47.3
NRCOP-10	2.5	2.5	23.9	20.7	8.0	4.7	5.5	3.5	40.7	41.7
Average	2.7	2.6	25.7	21.7	6.5	4.2	6.0	4.4	47.1	49.2
Range	2.4-3.1	2.4-2.8	23.7-28.1	20.3-23.1	5.1-8.0	2.8-4.9	5.2-8.0	3.5-5.5	40.7-61.1	41.7-59.1
SE ±	0.3	0.15	0.8	0.5	0.7	0.6	0.7	0.5	4.2	3.7
CD at 5%	N.S.	N.S.	2.5	1.7	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Material and Methods

The experiment on evaluation of new cross combinations in oil palm was initiated at Agricultural Research Station, Mulde, Tal. Kudal, Dist. Sindhudurg, Maharashtra (India) in September, 2007. The experimental station is located at 16°2' latitude, 73°42' longitudes and at 17 m elevation above mean sea level in Konkan region of Maharashtra, which is a coastal part with an annual rainfall of 3000 mm received during June to September. The minimum temperature ranges from 12° to 24°C and maximum temperature from 26° to 38°C with average 80 per cent relative humidity. The soils are having hilly topography and lateritic to alluvial coarse shallow type and well drained with 10 to 15 per cent slope. Ten Dura x Pisifera hybrids *viz.*, NRCOP-1, NRCOP-2, NRCOP-3, NRCOP-4, NRCOP-5, NRCOP-6, NRCOP-7, NRCOP-8, NRCOP-9 and NRCOP-10 developed by IIOPR, Pedavegi were constituted as a treatment and evaluated during the investigation. The sprouts of planting material were procured from the Scientist In-Charge, IIOPR, Research Center Palode, Kerala, during 2005 and field planting was done in September, 2007. The palms were planted in Randomized Block Design with three replications 9 x 9 x 9 m spacing in triangular system. Nine palms of each hybrid constituted the experimental material in each replication. The crop was nourished by giving full dose of 1200:600:2700 g NPK/palm/year from third year of plantation. During first and second year same fertilizer dose was applied @ 1/3 and 2/3 respectively. The crop was irrigated regularly to ensure proper growth after cessation of monsoon by providing two micro sprinklers with a discharge of 38 lit/hr in the basins. The data on palm height, girth, number of leaves, number of male, female inflorescences and fresh fruit bunch (FFB) yield of each palm in all the replications were recorded from year 2008 to 2015. However, data on height and girth for the year 2015 and for number of leaves, flowering and yield for the year 2013 to 2015 and pooled mean of these three years were discussed in the present investigation. The data was subjected to ANOVA as per the method given by Panase and Sukhatme (1985). The sex ratio was calculated by using following formula given below:

$$\text{Sex ratio \%} = \frac{\text{No. of female flowers/palm}}{\text{Total no. of flowers/palm}} \times 100$$

Results and Discussion

Growth and flowering:

The height and girth of different hybrids of oil

Table 2

Yield performance of different oil palm hybrids

Hybrid	No. of FFB/palm				Weight of bunch (kg/bunch)				Yield of FFB (t/ha)			
	2013	2014	2015	Pooled mean	2013	2014	2015	Pooled mean	2013	2014	2015	Pooled mean
NRCOP-1	3.1	2.3	5.1	3.5	6.8	7.5	13.1	9.1	3.1	2.4	9.7	5.1
NRCOP-2	4.3	4.3	6.5	5.0	6.5	8.1	13.8	9.5	4.1	5.0	12.8	7.3
NRCOP-3	4.4	3.5	4.8	4.2	5.1	5.9	10.7	7.2	3.4	2.9	7.4	4.6
NRCOP-4	2.9	3.5	5.3	3.9	5.2	6.9	11.9	8.0	2.1	3.4	8.9	4.8
NRCOP-5	3.6	2.8	5.3	3.9	5.6	6.5	11.4	7.8	2.9	2.5	8.8	4.7
NRCOP-6	4.3	5.0	5.6	5.0	5.5	6.8	11.4	7.9	3.4	4.9	9.1	5.8
NRCOP-7	3.9	5.6	4.7	4.7	5.9	7.3	12.3	8.5	3.4	5.7	8.3	5.8
NRCOP-8	3.9	4.3	5.2	4.5	7.8	9.3	13.0	10.0	4.3	5.7	9.6	6.5
NRCOP-9	4.3	4.8	5.4	4.8	6.5	7.0	12.4	8.6	4.0	4.8	9.5	6.1
NRCOP-10	3.4	3.0	5.4	3.9	5.0	6.5	11.6	7.7	2.6	2.8	8.5	4.6
Average	3.8	3.9	5.3	4.3	6.0	7.2	12.2	8.4	3.3	4.0	9.3	5.5
Range	2.9-4.4	2.3-5.6	4.7-6.5	3.5-5.0	5.0-7.8	5.9-9.3	10.7-13.8	7.2-10.0	2.1-4.3	2.4-5.7	7.4-12.8	4.6-7.3
SE ±	0.8	0.6	0.9	0.4	0.6	0.7	0.7	0.2	0.8	0.7	1.5	0.5
CD at 5%	N.S.	1.8	N.S.	N.S.	N.S.	2.1	2.1	0.6	N.S.	2.0	4.5	1.6

palm did not differ significantly (*Table-1*). The palm height ranged from 2.4 m to 3.1 m with average of 2.7 m. Numerically lower height was recorded in hybrid NRCOP-4 and NRCOP-5 (2.4 m) whereas girth ranged from 2.4 m to 2.8 m with an average of 2.6 m. The number of leaves produced by different hybrids was significant. During 2015 number of leaves ranged from 23.7 to 28.1 (NRCOP-7) with average of 25.7. Pooled mean number of leaves over the three years (2013-15) ranged from 20.3 to 23.1 (NRCOP-7) and average was 21.7. Data also revealed that there was no significant difference among different hybrids in respect of production of male, female inflorescences and sex ratio. During the years 2015 male inflorescences ranged from 5.1 to 8.0 with average of 6.5. While pooled mean over three years ranged from 2.8 (NRCOP-2) to 4.9 (NRCOP-1) with average of 4.2. Female inflorescences produced by different hybrids during 2015 ranged from 5.2 in hybrid NRCOP-7 to 8.0 in hybrid NRCOP-2 with average of 6.0. Pooled mean of three years showed that NRCOP-2 recorded maximum female inflorescences (5.5) and least was in NRCOP-10 (3.5). Average production of female inflorescences was 4.4. The hybrids NRCOP-2, NRCOP-7 and NRCOP-6 produced more number of female inflorescences over a period of three years under consideration. Sex ratio was highest (59.1%) in NRCOP-2 followed by NRCOP-8 (51.5%) and NRCOP-5 (51.1%). It was minimum (41.7%) in NRCOP-10 and low in NRCOP-1 (42.7%). In current investigation however average sex ratio was 49.2 per cent. In present investigation NRCOP-2 registered high sex ratio of 61.1 per cent during 2015 and 59.1 per cent over three years due to maximum female inflorescences and minimum male inflorescences. According to Abdul *et al.* (1988) in commercial oil palm material this ratio is about 70%. Gawankar *et al.*, 2002 reported yearly variation in sex ratio of individual genotype, which was obviously due to age of the early growing palms. Corley *et al.* (1976) suggested that sex ratio in oil palm can be modified by application of plant growth substances. This warrants that the hybrids under study have variability for hormonal constitution related with sex epression.

Fresh Fruit Bunches (FFB):

The data on number of bunches, bunch weight and yield of FFB per hectare of ten hybrids from 2013 to 2015 and pooled mean of three years is given in *Table-2*. In initial year the variation in yields was not significant. The data on number of bunches produced was significant for 2014 only. During the year 2013 number of bunches produced in hybrid NRCOP-3 were maximum (4.4) and least (2.9) in hybrid NRCOP-4 and average was about 3.8 per palm. During 2014 average number of bunches were 3.9 and

maximum in hybrid NRCOP-7 i.e. 5.6. Whereas, hybrid NRCOP-1 recorded only 2.3 bunches. Nevertheless, hybrid NRCOP-7 recorded 4.7 bunches in the year 2015 whereas, NRCOP-2 recorded maximum bunches i.e. 6.5 and average was about 5.3 bunches. Data on pooled mean for number of bunches was also non significant. However, for three years mean hybrid NRCOP-2 and NRCOP-6 recorded average of 5.0 bunches per palm. Anonymous (2015b) reported NRCOP-4 produced maximum number of bunches at Gangavati and Vijayarai centres. Data on weight of bunch was non significant during 2013 where average bunch weight was 6.0 kg and minimum in hybrid NRCOP-8 (7.8 kg). During 2014 also NCROP-8 recorded maximum bunch weight of 9.3 kg followed by 8.1 kg in NRCOP-2 while average bunch weight of hybrids was 7.2 kg. During 2015 hybrid NRCOP-2 recorded highest bunch weight of 13.8 kg followed by 13.1 kg in hybrid NRCOP-1 where average bunch weight among hybrids was 12.2 kg indicated that bunch weight was increased with advance in age of the palm. Similar results were reported at Gangavati centre where hybrid NRCOP-2 recorded more bunch weight and hybrid NRCOP-4 at Vijayarai centre (Anonymous, 2015b). Data also revealed that yield of fresh fruit bunches (FTB) was non significant during 2013 and significantly increased afterward. During 2013 average yield of hybrids was 3.3 t ha^{-1}. Yield of FFB was highest in hybrid NRCOP-7 and NRCOP-8 (5.7 t ha^{-1}) during 2014 and minimum in hybrid NRCOP-1 i.e. 2.4 t ha^{-1} with average of 4.0 t ha^{-1}. During 2015 hybrid NRCOP-2 recorded significantly higher FFB yield 12.8 t ha^{-1} and on par with other hybrids except NRCOP-3, NRCOP-7 and NRCOP-9. Average yield of FFB during 2015 was 9.3 t ha^{-1} which was more than double over previous years. The overall mean FFB yield of ten hybrids for three years was 5.5 t ha^{-1}. Considering this as truncation point, the performance of population was found to be low for initial two years. However, it must be noted that, the hybrid NRCOP-2 had the yield performance equivalent to truncation point even in three years of assessment. Pooled yield mean data revealed that yield variation is highly significant. Hybrid NRCOP-2 recorded 7.3 t ha^{-1} FFB yield followed by 6.5 t ha^{-1} in hybrid NRCOP-8 and on par with hybrid NRCOP-9, NRCOP-6 and NRCOP-7. Some hybrids like NRCOP-2, NRCOP-8 and NRCOP-9 showed high yield performance whereas, the hybrid likes NRCOP-3, NRCOP-4 and NRCOP-5 had poor yield performance though sex ratio was near to average sex ratio. However, these results are contra vestry with the results reported at Gangavati centre where hybrid NRCOP-4 has recorded higher yield and hybrid NRCOP-9 under Pattukkottai conditions (Anonymous, 2015b).

The study thus revealed that the population of oil palm hybrids under study is genetically variable. The average yield performance for three years showed that hybrid NRCOP-2 could be rated as most promising types followed by hybrid NRCOP-8, NRCOP-9, NRCOP-6 and NRCOP-7 as they had high yield performance since early age till final harvest and also had the high rate of increase in yield with advancement in age.

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