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Weather associated yield variability in Cashewnut

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ABSTRACT

Effect of weather components on year to year yield variation of cashew variety, Vengurla-1 for eleven year period 1991 to 2001 was studied. The maximum temperature, humidity and rainfall jointly proved to be major determinants of yield whereas, the relative humidity alone showed significant positive association with yield (r = + 0.89). Relative humidity during pre-blooming period proved key factor in explaining yield variation of this variety.

Key Words: Cashew, Yield, Weather parameter.

Maharashtra is one of the leading states in cashewnut production in India. The plantation of cashewnut in the state is rapidly increasing. As a result the area under cashewnut has increased to 1,21,200 ha upto 1999 (Anonymous, 1999). Up till now eight varieties, evolved at the Regional Fruit Research Station, Vengurle have been recommended by Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth for cultivation in the state. It is often noticed that the performance of cashew varieties is not uniform in the various agroclimatic regions of Maharashtra and is influenced by weather variation (Prasada Rao *et.al.* 1999). Even there are variations in its performance from west to east and north to south in the Konkan region of Maharashtra which constitutes two distinct agroclimatic zones viz., south Konkan coastal zone and north Konkan coastal zone. Vengurla-1, the test genotype is the first released variety in the state. The present investigation was thus intended to study the influence of climatic components having close relation with the yield in cashew variety Vengurla-1.

MATERIALS AND METHODS

The investigation was undertaken at the Regional Fruit Research Station, Vengurle, Dist. Sindhudurg (M.S.). The cashewnut plantation of variety Vengurla-1 planted by using grafts on 1 ha (208 nos.) area during 1979 constituted the experimental material. These plants were regularly and uniformly manured with green manure (50 kg) and 500:250:250 g NPK per tree. The need based plant protection measures were followed. The yield of these plants was recorded for whole season from January to May during 1991 to 2001 every year. The daily weather data were recorded and the weekly values were computed from August to December. The weather

Table 1 : Weather factors and yield for eleven years in cashew

Year	Yield (kg ha^{-1})	Max. Temp. (°C)	Min. Temp. (°C)	Humidity (%)	Rainfall (mm)	Rainy days
1990-91	1050	32.0	21.0	68	1413	124
1991-92	1172	32.0	19.4	65	2625	98
1992-93	1960	31.9	23.4	71	2552	88
1993-94	1107	32.5	19.8	65	2816	108
1994-95	1272	32.5	21.8	71	2389	132
1995-96	1856	32.2	18.5	73	3796	114
1996-97	1784	31.6	18.4	78	2763	86
1997-98	4392	32.4	22.3	85	3038	106
1998-99	2753	32.2	18.5	79	3138	133
1999-00	2299	32.2	19.2	77	3315	139
2000-01	1433	32.3	19.9	67	3831	136
Mean	1916	32.2	20.1	73	2879	14.9
C.V.	49	<1	8	8	23	16

parameters of the preceding year from the harvest were considered for yield relationship. The statistical analysis using regression model was done by the method suggested by Gomez and Gomez (1976).

RESULTS AND DISCUSSION

Pre-blossoming weather and cashew yield

The yield of cashew variety, Vengurla-1 was the highest in 1997-98 (4392 kg ha^{-1}) whereas, during 1990-91 it (1050 kg ha^{-1}) was the lowest (Table 1). The average yield of eleven years was 1916 kg with a C.V. of 49 per cent. Among the weather components the coefficient of variation for rainfall was maximum (23%) whereas it was the smallest for maximum temperature (<1%).

The magnitude of correlation coefficient between monthly weather parameters and yield are presented in Table 2. It was revealed that, humidity alone had close and highly significant positive association (r = + 0.89) with yield of cashewnut. None of the other weather parameters showed marked association with cashewnut yield.

Table 2 : Correlation co-efficient of yield with monthly weather parameters in cashew

Weather parameter	yield
Max. Temp.	0.150
Min. Temp.	0.214
Humidity	0.890**
Rainfall	0.313
Rainy days	0.031

** Significant at 1 per cent level

Table 3 : Weekly mean, and coefficient of variation (C.V.) of weather parameters

Met week	Max. Temp.		Min. Temp		Relative Humidity		Rainfall		Rainy days	
	Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
31	28.8	9	24.8	3	84.0	4	144.1	129	5.8	32
32	29.1	2	24.4	2	85.5	4	111.1	63	6.4	16
33	29.5	3	23.9	10	85.6	2	80.5	69	6.0	18
34	29.4	3	24.6	7	86.7	2	106.2	79	5.8	31
35	28.6	3	23.2	9	88.1	2	136.1	94	6.4	19
36	29.5	3	23.9	2	85.2	4	59.6	74	4.7	54
37	30.0	3	23.8	3	83.5	5	38.0	107	4.0	56
38	30.3	3	23.4	4	80.5	2	6.2	127	1.7	104
39	30.8	2	23.6	4	82.5	4	30.5	109	3.1	59
40	30.7	5	23.6	3	81.0	6	45.4	137	3.2	48
41	31.8	6	23.9	3	81.3	8	27.5	136	2.4	69
42	32.0	5	23.7	14	79.1	9	16.9	89	1.8	81
43	32.7	4	23.4	6	77.7	8	16.4	107	1.8	88
44	33.2	3	22.0	9	72.4	7	3.1	263	0.4	185
45	32.8	3	21.8	12	72.8	6	6.1	187	0.8	162
46	32.6	4	21.3	12	71.9	9	1.6	277	0.4	185
47	33.3	2	20.8	8	70.0	8	0.4	233	0.2	222
48	33.0	3	19.4	10	68.5	<1	-	-	-	-
49	32.7	3	18.9	12	67.4	6	4.7	317	0.27	327
50	32.5	2	18.3	14	67.1	6	-	-	-	-
51	35.6	29	18.1	18	63.0	18	-	-	-	-
52	32.0	4	18.2	11	65.4	5	-	-	-	-

Cashew starts flowering after cessation of monsoon rainfall. Vengural-1 is the early variety which starts flowering immediately after monsoon in the month of October. By the end of February harvesting is mostly completed in this variety. Hence, the variation in the weather components from August to December (week 31 to 52) are considered most important while establishing the association of yield with weather parameters and obviously need critical assessment. The analysis of weekly weather parameters indicated moderate variation for maximum and minimum temperature and relative humidity. During 1997-98 the yield level of was the highest when mean maximum temperature ranged between 28.8 and 33.8°C, minimum temperature between 16.9 and 24.5°C with relative humidity ranging from 71 to 92 per cent.

The mean and CV percent of weekly weather parameters are presented in

Table 4 : Step down multiple regression equations for yield of cashew on the basis of weekly weather parameters in August and September

Met. week	Regression equation	R^2
31	$Y= -3336.4981 + 1084.08(X_1) - 602.029(X_2) - 178.77(X_3) + 15.68 (X_4) + 298.12 (X_5)$	0.88*
33	$Y= -28461.1 + 608.24(X_1) - 203.22(X_2) + 202.19(X_3)$	0.85**
35	$Y= -60549 + 676.79(X_1) - 17.10(X_2) + 479.04(X_3) - 3.52(X_4) + 275.27(X_5)$	0.59

X_1 = Max. Temp., X_2 = Mini. Temp., X_3 = Relative Humidity, X_4 = Rainfall and X_5 = Rainy Days

*, ** Significant at 5% and 1% level of significance respectively.

Table 3. Weather variability was appreciable during 2nd and 3rd week of December, early October and mid-November to which cashewnut is exposed to in Konkan. The variation recorded by the rainfall and rainy days remarkably increased from late October and reached its maximum in early December.

An attempt was made to determine relative importance of weather parameters during August and September responsible for variation in cashew yield by step down multiple regression technique. Multiple stepwise regressions for three distinct weekly periods (met. weeks 31, 33 and 35) are shown in Table 4. Weather parameters of week no. 31 explained 88% variation in the yield followed by that of week no. 33 (85%) and week no. 35(59%). The equation developed with max. and min. temperature and relative humidity of week no. 33 can be used to predict the cashewnut yield variety vengurla-1, as R^2 value was significant at 1% level.

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