



INFLUENCE OF FLOWERING PARAMETERS ON NUT YIELD IN F₁ HYBRIDS OF CASHEWNUT

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Abstract

An experiment was conducted to study the flowering behavior in cashewnut at Cashew Research Station, Bapatla, Andhra Pradesh, India; during the year 2012-13. Significant variations were observed among hybrids for number of flowering laterals, flowering duration, panicle length and width, number of male, hermaphrodite and total number of flowers, sex ratio, apple weight, nut weight, kernel weight and nut yield per tree. Early flowering was observed in the hybrids H 77, H 85 and H 112, rest of the hybrids showed mid season flowering. Flowering duration varied from 63 (H 117) to 103 days (H 94). The hybrid H 94 produced highest total number of flowers (748.57), staminate flowers (566.57) and hermaphrodite flowers (182.00). Highest sex ratio also observed in H 94 (0.32).

Key words : Cashewnut, flowering, kernel and nut.

Introduction

Anacardium occidentale L. (Anacardiaceae, $2n = 42$), commonly known as cashewnut, is one of the most important dollar earning plantation crops of India. In India, the crop is cultivated in an area of 9.79 lakh ha with an annual production of 7.25 lakh tons (NHB, 2012). The highest productivity is observed in Maharashtra and Kerala with a value more than one ton per ha. As cashew is a highly cross-pollinated and heterozygous in nature, there is a great variability, sex ratio and also fruiting behavior. The presence of large number of staminate flowers, small percentage of hermaphrodite flowers is some of the factors responsible for low yield in cashew. The presence of less number of staminate flowers and high percentage of perfect flowers were desirable characters of high yielding cashew types.

Cashew Research Station (CRS), Bapatla is maintaining and evaluating several cross combinations in cashewnut on all India coordinated basis. A few of the F₁s being evaluated at the centre are performing consistently well over years were selected for the present

study with an objective of evaluating their morphological, nut and kernel parameters to assess their magnitude of performance as against the standard check BPP 8.

Materials and Methods

The experiment was conducted during the year 2012-13 with four trees per genotype. These F₁ hybrids planted in Randomised Block Design with three replications (year of planting – 1998). They are of fourteen years age. In each replication, four panicle from each plant that is one in each direction (E-W and N-S) were taken at random and tagged before flowering and subsequent panicle initiation at fifteen days interval was observed and duration of flowering was recorded. The just opened flowers were carefully removed from the panicles in every two days without damaging the existing buds with the help of forceps. The total number of flowers, male and hermaphrodite flowers were counted and the sex ratio was calculated. Observations on apple, nut and kernel parameters were recorded and the results obtained are discussed hereunder.

Table 1 : Flowering parameters of cashewnut hybrids.

Name of the hybrid	Flowering season	Date of flower initiation	Number of flowering laterals per m ² canopy	Flowering duration (Days)
H 77	Early	25 th Jan	22.45	85
H 85	Early	24 th Jan	24.92	98
H 94	Mid	1 st Feb	30.17	103
H 95	Mid	16 th Feb	28.67	79
H 104	Mid	10 th Feb	24.67	72
H 112	Early	20 th Jan	19.83	90
H 116	Mid	10 th Feb	24.58	93
H 117	Mid	12 th Feb	26.75	63
BPP-8	Early	23 rd jan	19.17	86
SEm			1.105	5.228
CD at 5%			3.383	16.011

Table 2 : Panicle characters among cashewnut hybrids.

Panicle size		Number of primary branches per panicle	Number of male flowers per panicle	Number of hermaphrodite flowers per panicle	Total number of flowers per panicle	Sex ratio
Length (cm)	Width (cm)					
17.21	19.75	8.12	299.20	57.00	356.20	0.19
17.75	19.54	8.14	530.97	95.64	626.61	0.18
18.59	23.64	9.86	566.57	182.00	748.57	0.32
15.29	19.42	8.11	303.03	42.00	345.03	0.14
14.88	25.34	8.33	558.87	45.00	603.87	0.08
14.78	16.96	9.33	412.60	66.00	478.60	0.16
17.37	24.59	8.14	255.87	73.00	328.87	0.29
14.21	20.59	9.00	241.10	29.75	270.85	0.13
16.83	23.56	9.53	409.00	63.00	472.00	0.15
0.58	1.36	0.33	36.16	3.11	35.69	0.01
1.78	4.16	1.01	110.74	9.54	109.31	0.04

Results and Discussion

Flowering characters

There were seasonal differences among all the hybrids (table 1). Early flowering was observed in the hybrids H 77, H 85 and H 112. Similarly mid season flowering was recorded by the hybrids H 94, H 95, H 104, H 116 and H 117. The date of flower initiation ranged from 20th January (H 112) to 16th February (H 95). Maximum number of flowering laterals per m² canopy (22.45) was recorded by H 77 whereas, the minimum values 19.83 were recorded by H 112. The duration of flowering ranged from 63 days (H 117) to 103.3 days (H 94). Among the hybrids the panicle length varied from 14.21 cm (H 117) to 18.59 cm (H 94). Panicle width ranged from 16.96 cm (H 112) to 25.34 cm (H 104). Maximum number of primary branches per panicle (9.86) was recorded by H 94 whereas, the minimum values were recorded by 8.11 (H 95). Maximum number of male

flowers per panicle (566.57) was recorded by H 94 whereas, the minimum values were recorded by H 117 (241.10). Among the hybrids, the number of hermaphrodite flowers per panicle varied from 29.75 (H 117) to 182 (H 94). Maximum sex ratio (0.32) was recorded by H 94 whereas, the minimum values were recorded by 0.08 (H 104).

As per descriptor list (IBPGR, 1986) for cashewnut, the flower initiation during the period of January-February was considered as 'early', February-March as 'mid' season and March-April as 'late' season in Northern Hemisphere. Under local agro-climatic conditions of Bapatla, out of 8 hybrids studied (table 1), mid flowering was observed in most of the (5 out of 8) the hybrids. These results are in conformity with the findings of Singh *et al.* (2008), Samal *et al.* (2006), Reddy *et al.* (2002b) and Reddy *et al.* (2001).

It is evident from the data presented in table 2 that

Table 3 : Apple and nut parameters of F₁ hybrids in cashewnut.

Name of the hybrid	Apple weight (g)	Nut weight (g)	Nut yield (Kg per tree)	Kernel weight (g)	Kernel grade
H 77	68.05	5.01	5.18	1.90	Medium
H 85	62.93	5.66	7.02	2.03	Medium
H 94	34.88	5.76	12.33	2.13	Medium
H 95	47.00	5.36	4.93	1.37	Medium
H 104	39.21	5.21	4.80	1.76	Medium
H 112	27.02	5.61	4.10	1.89	Medium
H 116	69.03	5.25	5.55	1.52	Medium
H 117	54.05	4.03	2.00	1.57	Medium
BPP-8	60.00	6.00	7.00	1.80	Medium
SEm	1.165	0.242	0.321	0.090	
CD at 5%	3.569	0.741	0.982	0.275	

longer panicles recorded lower width values and broader panicles were shorter in length among all the hybrids. Similarly a higher branching capacity as indicated by more number of primary branches per panicle was found to promote more number of total flowers per panicle. It is observed that sex ratio (number of hermaphrodite to male flowers) closely in association with hermaphrodite flowers, in all the hybrids (H 94 in set I, H 200 in set II and H 313 in set III). The variations in the panicle and flower parameters can be attributed to varietal character. It is interesting to note that longer duration of flowering, larger size of panicle (either in terms of length, width or length × width), higher number of primary branches per panicles were contributory to a higher total number of flowers per panicle. It can be placed on record that high yielding hybrids like H 94 and H 85 had recorded all these credits along with a higher number of hermaphrodite flowers per panicle thus gaining a larger sex ratio (hermaphrodite to male flowers). Significant differences among the panicle and flower parameters were also reported by Singh *et al.* (2008). Samal *et al.* (2006), Reddy *et al.* (2002b) and Mahesh *et al.* (2000).

Apple, nut and kernel characters

There were significant differences among the genotypes with respect to these parameters (table 3). Among the hybrids, the apple weight varied from 27.02 g (H 112) to 69.03 g (H 116). Nut weight ranged from 4.03 g (H 117) to 5.76 g (H 94). Maximum nut yield (12.33 kg per tree) was recorded by H 94, the minimum values were recorded by H 117 (2.00 kg per tree). Kernel weight ranged from 1.37 g (H 95) to 2.13 g (H 94).

The mean apple weight varied from 27.02 g to 69.03 g among the total hybrids under study. The variation in the apple weight could be due to genetic variability and varietal character. The descriptor list for cashew of

IBPGR (1986), suggested that the apple weights, from 36 to 43 g were to be considered as 'intermediate', while the weights lower than 36 g as 'low' and higher weights above 43 g as 'high' class. Based on this, H 94 and H 112 are 'low' in class, H 95 and H 104 comes under intermediate type, H 77, H 85, H 116 and H 117 are of high class. Similar studies also reported by Pereira *et al.* (2011), Desai, (2009), Lenka *et al.* (2003), Raquel *et al.* (2003), Reddy *et al.* (2002a) and Reddy *et al.* (2001).

An analysis of the data on nut parameters revealed that nut weight has not followed the trend in apple weight, thus indicating that it is not important to have larger apples for producing heavier nuts. Smaller apples also were found to bear larger nuts in some of the hybrids (for example H 94). Heavier apples did not necessarily bear heavier nuts which in turn did not necessarily produce heavier kernels. Most of the weight in nut might have been contributed from shell part and therefore nut weight could not in close harmony with kernel weight in some of the hybrids. Similar results of significant differences among the nut parameters were also reported by Desai (2011), Desai (2009), Mahesha *et al.* (2005), Haldankar *et al.* (2004), Vishnuvardhana *et al.* (2003) and Reddy *et al.* (2002a).

As regards to nut yield per tree, highest nut yield in kg per tree was recorded by H 94 followed by H 85. When we profoundly study other observations recorded by these hybrids, it is inferred that these superior hybrids were shorter in stature but stouter in girth values and had wide spread canopies. These hybrids were having either medium or small sized apples but produced bold sized nuts thus indicating that they could deposit maximum amount of photosynthetic assimilates into nut and thus maintaining an individual nut weight at higher order. Similar observation of significant differences among the values

of nut yield per tree was also reported by Reddy *et al.* (2001) and Lakshamana *et al.* (2001).

The kernel of cashewnut is edible, economical and processed part. The observations presented in Table 2 indicated that kernel weight had significant differences among the hybrids under study. Kernels weighing more than 2 g were observed in the hybrids H 94 and H 85 which were good yielding genotypes. The least values of these characters were recorded by poor yielders (H 95 and H 116) among all the hybrids. Significant differences among the values of kernel weight were also reported by Desai (2011) Desai (2009) and Dorajeerao (1999).

As per IBPGR descriptors, the kernel weight was categorized as low (less than 1.2 g), medium (1.2-2.5 g) and high (more than 2.5 g). None of the hybrids in the present study had high kernel weight. However, the hybrids were found to produce medium kernels.

Thus, it can be summarized that flower parameters contributed to a large extent to the yield and quality parameters of the hybrids since those hybrids having a good record of flower/panicle parameters also produced maximum out turn of nuts per tree. Under Bapatla conditions, longer duration of flowering, broader ratio of hermaphrodite to male flowers could have contributed to greater fruit set and retention which in turn took the advantage of maximum growth in size as well as weight over a period of time during the bearing season.

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