



FLOWERING PHASES AND THEIR INFLUENCE ON NUT YIELD IN CERTAIN CASHEWNUT HYBRIDS

M. Sreenivas, M. Lakshminarayana Reddy¹, A. V. D. Dorajeerao² and M. Paratpararao³

Horticultural College and Research Institute, Dr. YSR Hort. University, Venkataramannagudem, Tadepalligudem – 534 101, (Andhra Pradesh)

¹Dr. YSR Horticultural University, Venkataramannagudem, Tadepalligudem – 534 101 (Andhra Pradesh), India.

²Department of Horticulture, Horticultural College and Research Institute, Dr. YSR Hort. University, Venkataramannagudem, Tadepalligudem – 534 101 (Andhra Pradesh), India.

³Department of Plant Breeding, Horticultural College and Research Institute, Dr. YSR Hort. University, Venkataramannagudem, Tadepalligudem – 534 101 (Andhra Pradesh), India.

Abstract

Eight F₁ hybrids (fourteen year-old) at Cashew Research Station, Bapatla were evaluated for the occurrence of flowering phases during the year 2012-13. Most of the hybrids recorded flowering in three distinct phases by the occurrence of alternate cycles of different compositions of male and hermaphrodite flowers. Male phase (male flowers are more than hermaphrodites) and mixed phase (hermaphrodite flowers are more than male flowers) were found to alternate with each other. The hybrids H 77, H 95, H 104 and H 117 started flowering with male phase, whereas the remaining hybrids *i.e.*, H 85, H 94, H 112 and H 116 started flowering with mixed phase.

Key words : Cashewnut, flowering phases, nut weight and Kernel weight.

Introduction

Flowering is an important stage of plant's life. In case of perennials it matters a lot with regard to productivity as well as quality. Cashewnut (*Anacardium occidentale* L.) is an 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.

Cashew Research Station (CRS), Bapatla is one among the AICRP centres working on the crop, maintaining and evaluating several cross combinations. A few of the F₁s performing consistently over years were selected for the present study with an objective of understanding the duration of total flowering and how it was divided into different phases. It is also attempted to understand how the phases of flowering and their duration has a bearing on yield parameters among the selected hybrid varieties of cashewnut under Bapatla conditions.

Materials and Methods

A total of eight F₁ hybrids were planted in Randomised Block Design (year of planting –1998) and were evaluated during the year 2012-13 with four trees per genotype. They are of fourteen years age. Observations on flowering, apple, nut and kernel parameters were recorded and the results obtained are discussed hereunder.

The present study concentrated on flowering behavior of the hybrids. Based on daily counts of male and hermaphrodite flowers, it was noticed that flowering was in different phases. A phase was considered as male phase as long as male flowers continued to be more in number as compared to hermaphrodite flowers and *vice versa*.

Results and Discussion

Duration of flowering and flowering phases

Significant differences were noticed among the hybrids with respect of total duration of flowering and proportion of male and female flowers. The total duration of flowering was divided into different phases in a manner

unique to each genotype. Total duration of flowering was maximum in H 94 (103 days) and H 85 (98 days). Male phase and mixed phase were found to alternate with each other in many hybrids (table 1). The hybrids H 77, H 95, H 104 and H 117 started flowering with male phase, whereas the remaining hybrids *i.e.*, H 85, H 94, H 112 and H 116 started flowering with mixed phase.

First male phase lasted for the highest number of days (22) in H 77. The longest duration of first mixed phase was recorded by (45 days) in H 94. But, the first male phase was smallest (17 days) in H 104. And the smallest duration of first mixed phase was recorded by H 112 (22 days).

An examination on data on flowering phases gives an idea that most of the hybrids exhibited flower opening in three phases. Out of the total 8 hybrids two showed only two (male and mixed) phases and the rest recorded a third phase which was simulating first phase. When, we compare the duration of each phase and proportion of male and hermaphrodite flowers with other quantitative characters, it is inferred that not only the total duration of flowering, but the total duration of mixed phase either in single or two spells along with a higher proportion of hermaphrodite flowers is important to help for more fruit set and nut yield. Similar findings of differences in phases of flowering among cashewnut genotypes were also reported by Dorajeerao (1999), Ghosh (1988), Parameshwaran (1984) and Pavithran and Ravindranathan (1974).

Yield characters

There were significant differences among the genotypes with respect to these parameters (table 2). 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.*

Table 1 : Flowering phases in F_1 hybrids of Cashewnut.

S. No.	Hybrid	First phase		Second phase		Third phase			Total flowering duration	Percentage of staminate flowers	Percentage of hermaphrodite flowers
		Duration (Days)	Percentage of staminate flowers	Duration (Days)	Percentage of staminate flowers	Percentage of hermaphrodite flowers	Duration (Days)	Percentage of staminate flowers			
1	H77	22	40.78	1.39	9.26	10.25	16	33.98	4.38	84.00	16.00
2	H85*	33	10.49	12.58	74.25	2.68	-	-	-	84.74	15.26
3	H112*	22	8.43	10.46	74.25	1.8	21	3.53	1.53	86.21	13.79
4	H94*	45	15.26	19.25	60.43	5.06	-	-	-	75.69	24.31
5	H95	21	41.25	1.04	9.26	10.17	18	37.32	0.96	87.83	12.17
6	H104	17	39.48	0.23	5.21	7.01	18	47.86	0.21	92.55	7.45
7	H116*	24	10.5	10.78	60.2	3.15	20	7.1	8.27	77.8	22.2
8	H117	18	25.93	0.52	7.67	9.81	25	55.42	0.65	89.02	10.98
	SEm	0.506	—	—	—	—	0.579	—	—	1.876	1.876
	CD at 5 %	1.549	—	—	—	—	1.772	—	—	5.689	5.689

* Started flowering with mixed phase.

Table 2 : Apple, nut and kernel parameters of F₁ hybrids in Cashewnut.

Name of the hybrid	Apple	Nut		Kernel	
	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
SEm	1.165	0.242	0.321	0.090	
CD at 5%	3.569	0.741	0.982	0.275	

(2003), Reddy *et al.* (2002) 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) and Vishnuvardhana *et al.* (2003).

As regards to nut yield per tree, highest nut yield in kg per tree was recorded by H 94 followed by H 85. 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).

High yielders like H 94 and H 85 recorded longest duration of flowering as compared to other hybrids. Longest duration of flowering coupled with more number of male and hermaphrodite flowers were also seen in these hybrids (H 94 and H 85). They started flowering with mixed phase. These hybrids also recorded maximum nut, kernel weight and nut yield. Thus longest duration of flowering, flowering started with mixed phase appeared to have favoured best performance in respect of nut yield and kernel yield.

References

- Desai, A. R. (2009). Glimpses of cashew research in Goa. *ICAR research for Goa*, Technical bulletin number 17.
- Desai, A. R. (2011). Integrated Strategies through Classical and Modern Techniques for Crop Improvement in Cashew and Spices. *Annual report 2011-12. ICAR research for Goa*, 26-27.
- Dorajeerao, A. V. D., C. Ravisankar and M. L. N. Reddy (1999). Study on floral characters of different Cashew clones. *The Cashew*, **1** : 37-41.
- Ghosh, S. N. (1988). Studies on the flowering phases and the sex ratio in different cashew types at cashew research station, Jhargram. *The Cashew*, **II (1)** : 14-16.
- Haldankar, P. M., S. B. Deshpande, B. P. Patil and N. D. Jambhale (2004). Association of heterostyly with fruit set and nut size in cashewnut. *The cashew*, **18(3)** : 13-18.
- IBPGR (1986). Cashew Descriptor List International Bureau of Plant Genetic Resources, Rome.
- Lakshamana, H. Chandrappa, T. R. Guruprasad and G. K. Seetharamu (2001). Evaluation of cashew varieties performance under coastal zone of Karnataka. *The Cashew and Cocoa Journal*, Jan-March: 12-15.

- Lenka, P. C., K. C. Mohapatra and S. Samal (2003). Performance of cashew (*Anacardium occidentale* L.) types at Bhubaneswar (Orissa). *The Cashew*, **17(4)** : 12-17.
- Mahesha, U. S., S. I. Hanamashetti and N. K. Hegde (2005). Performance of Cashew (*Anacardium occidentale* L.) varieties under hill zone of Karnataka. *The Cashew*, Jul-Sept: 5-7.
- NHB (2012). NHB Interactive: Area & Production Report, *National Horticultural Board*. < <http://nhb.gov.in/area%20production.html>>.
- Parameshwaran, N. K., V. K. Damodaran and P. V. Prabhakaran (1984). Factors influencing yield in cashew. *Indian Cashew Journal*, **16(3)** : 9-15.
- Pavithran, K. and P. P. Ravindranathan (1974). Studies on the floral biology in cashew. *Journal of Plantation Crops*, **2(1)** : 32-34.
- Pereira, A. C. S., C. M. Reges and I. S. Reges (2011). Quality, bioactive compounds and antioxidant activity of cashew apples from precocious dwarf cashew clones CCP-09, CCP-76 and BRS-189. *Acta Horticulture*, 43-48.
- Raquel, B., Assuncao Z. Adriana and Mercadante (2003). Carotenoids and ascorbic acid from cashew apple (*Anacardium occidentale* L.): variety and geographic effects. *Food Chemistry*, **8(1)** : 495-502.
- Reddy, M. L. N., Gouse Mohammed and B. P. Kumar (2001). Studies on flowering and sex ratio in cashew (*Anacardium occidentale* L.) germplasm selections. *The cashew*, **15(4)** : 18-22.
- Vishnuvardhana, G. T. Thirumalaraju, Y. Raghuramulu, H. B. Lingaiah, Shivappa and N. Janakiraman (2003). Performance of Cashew entries / varieties under eastern dry zone of Karnataka. *The Cashew*, April-Jun: 18-21.