

Effect of Drip Irrigation on Flowering and Yield Performance of Cashew Varieties

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ABSTRACT

The experiment was conducted at Agricultural and Horticultural Research Station Ullal with an objective to study the influence of drip irrigation on reproductive and yield parameters of cashew crop. Providing drip irrigation recorded significantly highest number of flowering shoots (4.62), hermaphrodite flowers per panicle (12.87), panicles per m² (13.50), florets per inflorescence (9.85), Nuts per panicle (6.65), test weight (7.62 g) and nut yield per tree (14.01 kg). Among the varieties, Ullal-1 has recorded maximum number of flowering shoots (4.50), hermaphrodite flowers per panicle (12.80), panicles per m² (14.10), florets per inflorescence (10.80), nuts per panicle (6.38) and nut yield per tree (15.30 kg).

Key words: Cashew nut, Drip irrigation, Flowering characters, Yield

INTRODUCTION

Cashew (*Anacardium occidentale* L.) belongs to the family of anacardiaceae. It was introduced to India by Portuguese travellers during the 16th century. Cashew kernels rich in protein (21 %) and are used in confectionery and dessert. The shells contain a high quality oil known as cashew nut shell liquid (CNSL) which has got wide industrial uses. Cashew apple is eaten fresh or it can be used to make juice which is rich in ascorbic acid (Vitamin C), riboflavin (Vitamin B₂) and calcium. It is also used to prepare alcoholic drink (Feni). Cashew wood is used as fuel or low quality timber. It is grown worldwide in many countries due to its adaptability to varied soil

and climatic conditions. India is the leading producer and exporter of cashew nut in the world. The productivity of India is quite less, there is possibility of increasing production in the country if proper soil and water conservation measures are taken up¹³.

There are many ways to improve the productivity by growing of grafts of suitable variety, applying the recommended dose of fertilizers, following the recommended spacing and plant protection measures. Cashew experiences severe moisture stress from December to May, which adversely affects flowering and fruit set causing nut drop.

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In-situ water conservation in the soil profile is the most economic and practical means of ensuring sustainable availability of water to the plants during the dry spells¹⁰. Providing the irrigation after the flowering and during the summer can enhance the yield. So drip irrigation can be a better option to provide irrigation.

MATERIAL AND METHODS

The experiment was taken up at Agricultural and horticultural research station Ullal, Mangalore during 2015-16. It is located at 15m above mean sea level with a latitude of 13° N and longitude of 75° E. The soil type is a typical laterite with patches of red sandy loam. It is acidic in nature with a pH of 5.4 to 5.8. The Climate is usually hot and humid throughout the year with an average annual rainfall of 3232.58mm and distributed mainly from June to September by south west monsoon. The monsoon is usually followed by a long dry spell from October to May. The study was laid out in a factorial randomised block design with varieties and irrigation as two factors and replicated five times. Fifteen year old plants of eight varieties were included in the study. One set of varieties were irrigated by adopting drip irrigation and the other set was not irrigated. Plants were drip irrigated at the interval of 3 days at the rate of 10

litres/plant, after complete flowering and during the summer months. The five plants from each treatment and replication were selected and the observations of flowering and yield parameters were recorded.

Observations on flowering and fruiting behaviour of the trees were recorded at weekly intervals after initiation of inflorescence. The flowering shoots and panicles within one square meter of frame were counted and expressed in number. The number of florets in a inflorescence were counted and expressed as a numbers. Male flowers and perfect flowers were identified in each panicle and their average number was recorded after the opening of all the flowers. The observations were made in five tagged shoots. The total number of nuts retained in the panicle till maturity was counted and expressed in numbers. Hundred nuts from the middle of harvest were weighed and mean weight was expressed in grams/ nut. One kilogram of nuts from middle harvest was weighed, counted and expressed in number of nuts per kilogram. Weight of 100 whole kernel was taken and the average was expressed in grams / kernel.

One kilogram of nuts were taken for hard shelling, and the testa was removed from kernel and the shelling percentage was calculated as follows

Shelling percentage =

$$\frac{\text{Kernel weight}}{\text{Nut weight}} \times 100$$

The fallen nuts were collected from each tree and dried under sunlight, and the total nut weight was expressed as kilogram / tree.

RESULTS AND DISCUSSION

All the flowering parameters varied significantly among the varieties with respect to irrigation levels (Table 1). Plants provided with irrigation recorded significantly highest values for number of flowering shoots (4.62), hermaphrodite flowers per panicle (12.87), panicles per m² (13.50) and florets per inflorescence (9.85). Whereas, lowest male flowers (39.32) were found compared to

control. Similarly, Mishra *et. al*⁴, 2008 reported the significantly highest plant height, flowers per panicle and nuts per panicle in drip irrigated cashew plants compared to basin irrigation. The number of flowering shoots were maximum in Ullal-4 (4.80) on par with Ullal-1 (4.5) and Bhaskara (4.3), whereas the minimum was recorded in Ullal-3 (3.80). Among the interaction, variety Bhaskara and Ullal-4 under drip irrigation recorded highest number of flowering shoots (5.40) and the lowest was recorded in VRI-3 and NDR-2-1 (2.00).

Ullal-1 recorded significantly highest hermaphrodite flowers per panicle (12.80) on par with Ullal-2 (12.40), NDR-2-1 and Bhaskara (11.7). VRI-3 recorded lowest hermaphrodite flowers (10.60) in a panicle. Sharma *et. al*⁸, recorded maximum number of hermaphrodite flowers per panicle in hybrid-255 (613). Variety Ullal-2 provided with drip irrigation recorded highest number of hermaphrodite flowers per panicle (14.20) on par with Ullal-1(13.40) and NDR-2-1 (13.20). Whereas, lowest was recorded in UN-50 without drip irrigation (8.80).

The number of male flowers in a panicle ranged between 35.70 in Ullal-3 to 66.00 in Ullal-4. Among the interaction Ullal-3 had lesser number (29.60) of male flowers, followed by Bhaskara (34.40) and highest was recorded in Ullal-4 (66.80). Among the varieties Ullal-1 recorded maximum number of panicles per m² (14.1), which was on par with Ullal-2 (13.50), Ullal-3 (13.30) and Bhaskara (13.00) and the lowest was found in NDR-2-1 (10.60). Results are in conformity with Rajanna *et. al*⁵, and Srinivas *et. al*⁹. Ullal-1 under drip irrigation recorded maximum number of panicles per m² (16.20) and it was on par with Bhaskara (14.40). The lowest number of panicles per m² was recorded in NDR-2-1 (10.00).

Ullal-1 recorded maximum number of florets per inflorescence (10.80) on par with Ullal-4 (10.30), UN-50 (10.00) and Ullal-2 (9.70). Whereas, Ullal-3 recorded minimum number of florets per inflorescence (8.00). Among the interactions Ullal-1 recorded maximum number of florets per inflorescence (11.60) on par with Ullal-4 (10.60) and Ullal-2 (10.20). Lowest number of florets per inflorescence were recorded in Ullal-3 (7.40).

All the yield parameters were found significant among varieties with respect to irrigation. Nuts per panicle ranged from 5.71 in Ullal-4 to 6.55 in Ullal-2. Vikram *et. al*¹², reported significantly higher number of nuts per panicle in Vengurla-4 (10.11) followed by Ullal-3 (7.75) and Goa-11/6 (7.06), whereas lowest was recorded in VRI-3 (4.63). Drip irrigation had highest number of nuts per

panicle (6.65) compared to control (5.28). Similarly, Mishra *et. al*⁴, reported highest nuts per panicle in drip irrigated plants. Among interaction Ullal-2 had highest number of nuts per panicle (7.88) and the lowest was found in Ullal-3 (4.82).

The test weight of the nuts varied between 5.08 g in Ullal-2 to 8.14g in Ullal-3. The test weight was maximum in the drip irrigated plants (7.62 g) compared to control (6.13 g). In the interactions Ullal-3 recorded maximum test weight (9.30 g) and minimum (4.75 g) was found in Ullal-2. The nuts per kilogram was highest in Ullal-2 (181.70) and lowest was found in Ullal-3 (108.50). Hanumanthappa *et. al*¹, Lakshmana *et. al*³, Rajanna *et. al*⁵, Reddy *et. al*⁶, Venkataramana *et. al*¹¹, reported variation for nut weight. Ullal-2 recorded maximum number of nuts per kilogram (182.2) followed by Ullal-2 (181.2) under drip irrigation and minimum was recorded in Ullal-3 (106.8) under drip irrigation. The results are in conformity with Mishra *et. al*⁴.

Nut yield per tree ranged between 10.71 kg in UN-50 to 20.75 kg in NDR-2-1. Among the irrigation levels drip irrigation recorded highest nut yield per tree (14.01) compared to control (13.14 kg). Similarly, among the cultivars evaluated at ullal, the nut yield per tree was maximum in NDR-2-1 (20.89 kg) followed by 11/6 Goa (14.59 kg) and the lowest (7.71 kg) was observed in Selection-2³. Zachariah *et. al.*, reported maximum nut yield of 18.60 kg per tree in Dharasree, followed by 18.35 kg per tree in Amrutha. NDR-2-1 has recorded maximum nut yield of 21.39 kg under drip irrigation. Whereas, Bhaskara had lowest yield (9.82 kg) among the interactions. Reddy *et. al*⁷, reported highest fruit yield and fruit weight of mango in the drip irrigated plants. Hemant kumar Panigrahi *et. al*², recorded higher yield and yield attributing characters in drip irrigated plants of mango.

The shelling percentage ranged between 31.23 % in VRI-3 to 32.43 % in UN-50. Results were in conformity with several workers. Venkataramana *et. al*¹¹, reported

highest shelling percentage in T.No 4/3(36.165) followed by T.No-228 (35.365) and lowest shelling percentage was noticed in T.No 6/14 (25.255 g). Rajanna *et. al*⁵, and Reddy *et. al*⁶, reported variation in shelling percentage among the genotypes. Among the interactions, UN-50 with drip irrigation had highest shelling percentage (32.45) and the

lowest was found in VRI-3 (31.22). Kernel weight was maximum in UN-50 (2.31 g) and it was on par with VRI-3 (2.23 g). whereas lowest was recorded in Ullal-4 (2.02 g). Among the interactions UN-50 had highest kernel weight (2.42 g) on par with Ullal-3 (2.33 g) and the lowest kernel weight was recorded in NDR-2-1 and Ullal-4 (2.00 g).

Table 1: Effect of drip irrigation on flowering characters of cashew varieties

Sl. No.	Varieties	Flowering shoots			Hermaphrodite flowers per panicle			Male flowers per panicle			Panicles per m ²			Florets per inflorescence		
		Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean
1.	Ullal-1	5.2	3.8	4.5	13.4	12.2	12.8	38.2	42	40.1	16.2	12	14.1	11.6	10	10.8
2.	Ullal-2	3.2	2.6	2.9	14.2	10.6	12.4	36.6	40.2	38.4	14.2	12.8	13.5	10.2	9.2	9.7
3.	Ullal-3	4.6	3	3.8	12.6	10	11.3	29.6	41.8	35.7	13.6	13	13.3	8.6	7.4	8.0
4.	Ullal-4	5.4	4.2	4.8	11.6	10.6	11.1	66.8	65.2	66.0	12.6	10.2	11.4	10.6	10	10.3
5.	UN-50	4.2	2.2	3.2	12.6	9.2	10.9	36.8	60.2	48.5	12.4	12.2	12.3	10	10	10.0
6.	VRI-3	4.4	2	3.2	12.4	8.8	10.6	35.6	62	48.8	13.4	12	12.2	9.6	9.2	9.4
7.	NDR-2-1	4.6	2	3.3	13.2	10.2	11.7	36.6	61	48.8	11.2	10	10.6	9.4	8.4	8.9
8.	Bhaskara	5.4	3.2	4.3	13	10.4	11.7	34.4	42.6	38.5	14.4	11.6	13.0	8.8	7.8	8.3
Mean		4.62	2.87		12.87	10.25		39.32	51.87		13.50	11.60		9.85	9.00	
CV %		32.73			11.29			3.40			11.44			15.63		
		S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)
Varieties		0.39		1.09	0.41		1.17	0.49		1.39	0.45		1.29	0.47		1.32
Irrigation		0.19		0.55	0.21		0.59	0.25		0.69	0.23		0.65	0.23		0.66
Varieties X Irrigation		0.55		1.55	0.58		1.66	0.69		1.96	0.64		1.82	0.66		1.86

Table 2: Effect of drip irrigation on yield characters of cashew varieties

Sl. No.	Varieties	Nuts/panicle			Test weight			Nuts/kg			Nut yield/tree			Shelling %			Kernel weight		
		Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean	Drip irrigation	Control	Mean
1.	Ullal-1	7.25	5.52	6.38	7.78	4.78	6.28	128.2	132.0	130.10	15.48	15.12	15.30	31.62	31.62	31.62	2.23	2.22	2.22
2.	Ullal-2	7.88	5.22	6.55	5.57	4.75	5.08	181.2	182.2	181.70	12.91	11.62	12.26	31.62	31.62	31.62	2.03	2.06	2.04
3.	Ullal-3	6.75	4.82	5.78	9.30	6.98	8.14	106.8	110.2	108.50	14.22	13.12	13.67	31.87	31.82	31.84	2.33	2.12	2.22
4.	Ullal-4	6.5	4.92	5.71	7.47	6.80	7.13	134.6	136.4	135.50	13.38	13.32	13.35	31.87	31.72	31.79	2.04	2.00	2.02
5.	UN-50	6.88	5.12	6.00	8.84	6.60	7.72	114.8	118.6	116.70	10.52	9.82	10.17	32.45	32.42	32.43	2.42	2.20	2.31
6.	VRI-3	6.23	5.22	5.72	7.68	6.7	7.19	121.2	123.2	122.20	12.58	11.62	12.10	31.24	31.22	31.23	2.25	2.20	2.23
7.	NDR-2-1	5.75	5.82	5.78	7.08	6.50	6.79	141.8	143.4	142.60	21.39	20.12	20.75	32.37	32.38	32.37	2.09	2.00	2.04
8.	Bhaskara	6.02	5.62	5.82	7.26	6.1	6.68	138.2	140.4	139.30	11.64	10.42	11.03	31.25	31.26	31.25	2.16	2.10	2.13
Mean		6.65	5.283		7.62	6.13		133.35	135.8		14.01	13.14		31.78	31.75		2.19	2.11	
CV %		2.82			2.69			1.70			2.36			0.50			4.12		
		S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)	S.Em±		CD (5%)
Varieties		0.05		0.15	0.06		0.17	0.73		2.06	0.10		0.29	0.05		0.14	0.03		0.08
Irrigation		0.03		0.08	0.03		0.09	0.36		1.03	0.05		0.14	0.03		0.07	0.01		0.04
Varieties X Irrigation		0.08		0.21	0.08		0.26	1.03		2.91	0.14		0.41	0.07		0.20	0.04		0.11

CONCLUSION

Providing irrigation through drip after the development of flowers at three days' interval at the rate of 10 litres per plant enhanced the fruit and seed development and thereby the yield of cashew nut is increased.

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