Indian Journal of Agriculture Business
Volume 5 Number 1, January - june 2019
DOI: http://dx.doi.org/10.21088/ijab.2454.7964.5119.3

Original Article

Effect of Irrigation Methods on Biometric Development of Litchi

R.D. Bansod

How to cite this article:

R.D. Bansod. Effect of Irrigation Methods on Biometric Development of Litchi. Indian Journal of Agriculture Business. 2019;5(1):21-24.

Author's Affiliation
Head, Dept. of Soil and Water Conservation Engg, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413722, India.

Coressponding Author:
R.D. Bansod, Head, Dept. of Soil and Water Conservation Engg, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413722, India.

E-mail: rtuljapur1808@gmail.com

Received on 05.02.2019

Accepted on 28.06.2019

Abstract

The comparative effect of different methods of irrigation such as, microsprinkler + drip (T_1), surface (T_2) and surface + drip (T_3) was studied on Biometric development of Litchi. Surface and microsprinkler irrigation were applied to Litchi when there was intercrop, however drip irrigation was applied during lean period (no intercrop period). The highest crop canopy, 12.10 m^2 was recorded in T_1 and lowest, 10.50 m^2, in T_2. The maximum girth (29.0 cm), shoot length (49.2 cm) and plant height (288.25 cm) were recorded in T_1. The yield of Litchi obtained in T_1, T_2 and T_3 was 374.72, 271.48 and 300.27 kg/ha respectively. The number of fruits, fruit weight and fruit diameter were also maximum in T_1. The significant increase of yield in T_1, 38.02% over T_2 and 10.60% over T_3 and overall better performance of Litchi in T_1 was might be due to frequent irrigation, uniform moisture distribution in the soil profile and better utilization of nutrients by the crop for its full growth during intercrop period.

Keywords: Biometric; Irrigation Methods; Litchi

Introduction

The field experiment was conducted, to study the response of litchi to different methods of irrigation in respect of biometric development and yield components. In between the litchi cucumber and cauliflower were taken as intercrops. The irrigations were applied by surface irrigation method and also by water saving methods such as drip and microsprinklers were used as irrigation methods. Under drip irrigation the soil moisture is maintained at field capacity and throughout the growth period, resulting into higher yield of yield parameters of tomato (Danawale N.J. *et al,* 2018).

Materials and Methods

Irrigation treatments for litchi

The irrigation treatments were based on the period of intercrops and the lean period. The irrigation was applied to litchi and intercrops by microsprinkler and surface irrigation methods during the intercropping period. During the initial and harvesting stages of intercrop the water demand of litchi was fulfilled through drip method to avoid the overirrigation to litchi. During the lean period (when there was no intercrop), the irrigation was applied through drip and surface. The information

of irrigation treatments applied in litchi is given in Table 1. In case of microsprinkler + drip treatment, no separate laterals were required however, the laterals used for the microsprinklers (12 mm) were brought in use with some arrangement for drip irrigation so as to reduce the cost of extra laterals. The laterals and the drippers were placed near the litchi at a grid of 8 m x 8 m. In case of surface irrigation method, basin method of irrigation was applied.

Table 1: Treatments details

Treatment	Period	
	When there was intercrop	No intercrop (Lean) and gap period
Microsprinkler + Drip (T_1)	Microsprinkler	Drip
Surface (T_2)	Surface	Surface
Surface + Drip (T_3)	Surface	Drip

Experimental details

In addition to the various components of experimental set up used for cauliflower and cucumber intercropping, the pressure compensating drippers of 4 l/h discharge capacity were used for the drip irrigation under microsprinkler + drip and surface + drip treatments. The details of the experiment are presented in Table 2.

Table 2: Experimental details of litchi

Sr. No.	Particulars	Irrigation method		
		Microsprinkler + Drip	Surface + Drip	Surface
1.	Plot size, m x m	32 x 40	16 x 40	16 x 40
2.	Plant spacing, m	8 x 8	8 x 8	8 x 8
3.	No. of rows in each plot	4	2	2
4.	No. of plants in each row	5	5	5
5.	Total no. of plants in each treatment	8	10	10
6.	No. of obs. plants	8	8	8
7.	Lateral spacing, m	8	8	-
8.	Spacing between emission devices, m	8	8	-
9.	No. of microsprinklers in corresponding plot	8	-	-
10.	No. of emitters in corresponding plot	16	20	-

Irrigation scheduling and water application

Irrigation water management to litchi was mainly based on intercropping and lean period. During the intercropping period irrigations were applied by surface and microsprinkler methods however during lean period, irrigations were applied through drip irrigation system in two treatments (T_1 and T_3). The water application and irrigation scheduling for respective irrigation treatments were as given below.

Drip irrigation

Drip irrigation system operates at lower pressure as compared to sprinkler and microsprinkler irrigation systems. Water application near the root zone with lower rate is possible through the emitting device, dripper. The irrigation requirement was estimated by considering crop coefficient during growth period and pan evaporation data.

The method given by INCID (1994) was used for estimation of crop water requirement. The following relationship was used for estimation of crop water requirement.

$$V = Kp \cdot Ep \cdot Kc \cdot Wp$$

Where,

V = Water requirement of the plant, l/day

Kp = Pan coefficient

Ep = Pan evaporation, mm/day

Kc = Crop coefficient

Wp = Wetted area, m^2

The Kc values for litchi were obtained by the method suggested by Doorenbos and Pruitt (1977) as experimentally determined values of Kc were not available.

Surface irrigation

The irrigation scheduling in this treatment was given on the basis of 50 per cent depletion of the total available soil water in the effective root zone. The depth of irrigation was applied in the range of 5 to 6 cm. Soil samples were taken before and after each irrigation to measure the moisture content in the profile and measured quantity of water was applied in the basin having 25 m length and 0.6 m width when the soil moisture depleted 50 percent. The irrigation scheduling of the litchi during the intercrop period was based on the irrigation scheduling of the inter crop.

The observations of different growth and yield parameters such as plant height, girth, shoot length, canopy area, number of fruits per plant, fruit weight, and yield of litchi were recorded at an

interval of 45 days with starting the first observation from 1490th day of planting of litchi.

Results and Discussions

Effect of methods of irrigation on biometric growth parameters of litchi

Biometric parameters of litchi

The observations from eight tagged plants from each treatment related to canopy area, plant height, girth and shoot length of litchi were recorded at an interval of 45 days. The respective results obtained are presented as under.

Canopy area

The canopy area of litchi was recorded under different irrigation treatments at an interval of 45 days. It is observed that the irrigation method, microsprinkler + drip (T_1) resulted in higher canopy area over the surface (T_2) and surface + drip (T_3). The canopy area recorded in, T_2 and T_3 was 12.10, 9.0 and 10.50 m^2, respectively. The highest canopy area recorded in T_1 was due to frequent application of water through microsprinklers during the intercrop period, which resulted in even distribution of the applied water near the root zone. The application of water through drip irrigation during the lean period also improved the water distribution and application efficiency hence more canopy area was recorded in T_1. The per cent increase of the canopy spread over surface irrigated plants was 34.44 and 16.77% for micro-sprinkler + drip and surface + drip irrigation, respectively. The trend of variation in canopy area among different irrigation methods was more or less similar to that of other vegetative growth parameters. The empirical equations developed for Canopy area in relation to duration from planting are shown in Table 3.

Table 3: Empirical equations relating canopy area of litchi with duration

Sr. No.	Treatment	Fitted equation	Correlation coefficient, R^2
1.	T_1	$C = -0.0171D^3 - 0.194D^2 + 1.782D + 6.16$	0.990
2.	T_2	$C = -0.0662D^3 + 0.494D^2 - 0.240D + 7.26$	0.997
3.	T_3	$C = -0.0165D^3 + 0.1235D^2 + 0.2456D + 6.82$	0.986

C – Canopy area, m^2, D – Duration from planting, days

The empirical equations (Table 3) were developed relating canopy area with the duration since planting of litchi.

Plant height

The maximum plant height (288.25 cm) was achieved in case of micro-sprinkler + drip irrigated plants followed by surface + drip (255.87 cm). The minimum (246.12 cm) height was observed in surface irrigation treatment. The analysis of variance of observed data showed that methods of irrigation had highly significant effect on plant height of litchi. The per cent wise increase in mean plant height over surface irrigated plant was 17.27 and 4.06% for micro-sprinkler + drip and surface + drip irrigated plants, respectively (Table 4).

Table 4: Empirical equations relating plant height of litchi with duration

Sr. No.	Treatment	Fitted equation	Correlation coefficient, R^2
1.	T_1	$PH = -0.028D^3 + 2.00D^2 + 13.19D + 204.1$	0.998
2.	T_2	$PH = -0.008D^3 - 0.96D^2 + 15.44D + 199.8$	0.998
3.	T_3	$PH = -0.330D^3 - 3.57D^2 + 21.09D + 198.0$	0.997

PH - Plant height, cm, D – Duration from planting, days

Girth of litchi

The treatment T_1 produced higher girth of Litchi over T_2 and T_3. The treatment wise girth of litchi recorded was 29.0, 25.8 and 26.58 cm for T_1, T_2 and T_3. The difference in girth amongst the treatment was less during initial observations however it increased with the time from planting. The per cent increase in litchi girth in microsprinkler + drip irrigation and surface + drip irrigation over the surface irrigation was recorded as 12.40 and 3.02%. The maximum girth of litchi was attained in microsprinkler + drip irrigated plants because of uniform and frequent application of water at right time during the entire period which resulted in uniform moisture distribution in the soil profile and better utilization of the moisture. The empirical equations presented in Table 5, were developed relating the girth of litchi with time.

Table 5: Empirical equations relating girth of litchi with duration

Sr. No.	Treatment	Fitted equation	Correlation coefficient, R^2
1.	T_1	$G = -0.045D^3 + 0.407D^2 + 0.252D + 23.17$	0.998
2.	T_2	$G = -0.004D^3 + 0.055D^2 + 0.509D + 22.38$	0.998
3.	T_3	$G = -0.012D^3 + 1.143D^2 + 0.415D + 22.48$	0.999

G – Girth of litchi, cm, D - Duration from planting, days

Shoot length

The shoot length was recorded at an interval of 45 days. The mean shoot length was increased in all treatments from 1529th to 1664th day from planting after then the overall length of shoot was constant. The minimum shoot length recorded in T_1, T_2 and T_3 was 25.1, 22.8 and 23.0 cm on 1529th day from planting. The shoot length recorded on 1709th day from planting was 49.2 cm in T_1, 34.1 cm in T_2 and 38.1 cm in T_3. day from planting. The increase in shoot length in T_1 over T_2 was 44.28%. The treatment T_3 recorded 5.57% increase of shoot length over T_2. The shoot length was significantly affected by irrigation methods.

Number of fruits

The maximum, 120.5 numbers of fruits was recorded in T_1. The number of fruits recorded in T_2 and T_3 were 102.2 and 105.6, respectively. The increase in fruit number over surface irrigation was 17.90 and 3.32%, respectively in T_1 and T_3. The higher number of fruits recorded in T_1 was due to overall better development and growth of plant irrigated under microsprinkler + drip irrigation (Table 6).

Table 6: Effect of irrigation methods on number of fruits

Sl. No.	Irrigation methods	Number of fruits/plants
1	Microsprinkler + Drip	120.5
2	Surface	102.2
3	Surface + Drip	105.6

Conclusion

The treatment based on microsprinkler and drip combination was found superior over surface and also surface and drip combinations. Silmilar higher yields in horticultural crops were also reported by Sezen *et al.* (2010) and Sharda *et al.* (2011). Desshmukh *et al.* (2014).

The minimum (54.83 cm) depth of water was applied in case of microsprinkler + drip irrigated plots followed by surface + drip (87.07 cm) and surface irrigation (87.31 cm) in ascending order. The water saving in case of microsprinkler + drip and surface + drip irrigation over surface irrigation was estimated as 37.20, and 0.3%, respectively. Thus, maximum saving of irrigation water was achieved in case of microsprinkler + drip treated plots whereas, a small saving of water was achieved in case of surface + drip irrigation method.

References

1. Danawale N.J., Tumbhare A.D and Nimbalkar C.A. Effect of different irrigation regimes and fertigation schedule through drip on tomato production during rabi season. Contemporary research in India. Special issue on national seminar on PSAR. Jan 2018:11-14.
2. Deshmukh G and Hardaha M.K. Effect of irrigation and fertigation scheduling under drip irrigation in papaya. Journal of Agri Search. 2014;1 (4):216-20.
3. Sezen Metin S., Celikel, Gulendum, Yazar, Attila, Tekin, Servet and Kapur, Bureak. Effect of irrigation management and yield quality of tomatoes grown in different soilless media in glasshouse. Scientific research essay. 2010;5(1):14-48.
4. Sharda Rakesh Kaushal, M.P., Siag, Mukesh and Biwalkar, Nilesh. Economic evaluation of sub surface drip system in tomato. Progressive horticulture. 2011;43(1):66-71.