

## Effect of irrigation and mulching on establishment of ber (*Ziziphus mauritiana*) plantation in Jharkhand

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**ABSTRACT :** An experiment was conducted at Research Farm of Indian Institute of Natural Resins and Gums (IINRG), Namkum, Ranchi during 2007-09 on efficacy of irrigation and mulching on establishment of *ber* (*Ziziphus mauritiana*) plantation. The treatments comprised three levels of irrigation and two levels of mulching. Irrigation with mulching showed a pronounced effect on plant growth parameters. Pooled data for June month showed an increase of 42, 40 and 36% in basal girth, number of leaves and number of branches for *ber*, however, plant height did not show any significant difference. Irrigation alone, without mulching, also showed a substantial increase in case of number of leaves, however, there was none significant difference between basal girth and number of branches.

**Key Words:** Basal girth, *ber* (*Ziziphus mauritiana*), irrigation, mulching.

*Ber* (*Ziziphus mauritiana*) is a hardy lac host on which both strains of Indian lac insect *Kerria lacca* Kerr (Homoptera:Tachardiidae) *i.e.*, *kusmi* and *rangeeni* thrive well and complete their life cycle during rainy and winter (*katki* and *aghani*) seasons. It occupies an important position in the list of conventional hosts (*kusum*, *ber* and *palas*). Among these lac hosts, utilization of *ber* is high due to its wide distribution in homestead area and farmers' land holding/bunds.

In upland conditions, growth of the plant is slow probably due to moisture stress faced by the plant during summer months, resulting in delayed establishment of plantation. Application of irrigation along with mulching practices can result in early establishment. A study at Indian Institute of Natural Resins and Gums (IINRG), Ranchi has shown that mulching with locally available grasses at the rate of 10 kg/plant significantly increased the plant height, basal girth and crown spread of *ber* by 22.8, 24.2 and 28.9% during the entire period of study (2005-2009) over control *i.e.*, without mulching under rainfed condition (Singh, 2009). In another study conducted at CAZRI, Jodhpur, the results of the field trial showed that even during low rainfall years, circular catchment technique increased the mean soil profile mois-

ture storage by 10-30 mm/m and improved the growth and fruit yield of *ber* plants (Gupta, 1984). Keeping these points in view, an experiment was conducted during 2007-08 and 2008-09 for establishment of *ber* plantation using irrigation and mulching to assess its efficacy on plant growth parameters.

### Materials and Methods

The experiment was conducted at Research Farm of Indian Institute of Natural Resins and Gums (IINRG), Namkum, (23°23' N longitude, 85°23' E latitude and 650 m above MSL) during 2007-09 in Ranchi district of Jharkhand. The soil of the experimental plot was of sandy loam texture with acidic soil reaction and low organic carbon content.

The experiment comprised three levels of irrigation *i.e.*, irrigation at fortnightly and monthly intervals and control (no irrigation) and two mulching levels (mulching and no mulching). Twenty five litres of water was applied in each irrigation in the basin of 1 m diameter around each plant. Mulching was done with locally available grasses with 1" thick paddy straw under each level of irrigation after cessation of monsoon rains.

Seedlings of *ber* were transplanted in July 2007 in moist soil condition and scheduling of irrigation

was started from February 2008, as water deficit in soil increases after cessations of winter rain. All six combinations of treatments were replicated four times in Randomized Block Design (RBD) in factorial mode. Soil moisture content was determined by gravimetric method (w/w) from 30cm depth at different time intervals.

## Results and Discussion

### Soil Moisture Content

Table-1 showed that in case of irrigation at 15 days interval, effect of mulching was pronounced, but in case of irrigation at 30 days interval, effect was pronounced during harsh days only *i.e.*, after mid April when it experienced rainless days for a long time. In some occasions *i.e.*, on 4<sup>th</sup> week of May moisture content under mulching was less than no mulch. The reason may be attributed to the fact that the mulch material acted as a barrier, preventing rain water to infiltrate into the soil, in case of small amount of rainfall.

### Plant Growth

To visualize differences in treatment effects, observations on plant growth characters *i.e.*, plant height, basal girth, number of branches and number of leaves was recorded from time to time. Initial observation in the month of January showed that there were no significant differences among different treatments, but treatment differences were observed with lapse of time (Table 2). Effect of irrigation and mulching on plant growth parameters has been discussed in following sections :

#### (A) Effect of Irrigation

Data recorded at the end of May showed that application of irrigation fortnightly has increased number of leaves/plant significantly (Table 2). An increase of 120 and 223% in number of leaves were observed in monthly and fortnightly irrigated plants as compared to control in stress period *i.e.* May. Other plant growth characters like basal girth and number of branches remained at par, though higher value was

recorded in irrigated plants. However, due to rain in June, effect difference was nullified and the values pertaining to all growth characters were at par.

#### (B) Effect of Mulching

Unlike irrigation, mulching showed more pronounced effect on plant growth. Basal girth and number of leaves were significantly affected both in May and June months due to mulching. An increase of 46 and 84% in basal girth and number of leaves per plant, respectively, were observed due to mulching as compared to no mulch in the month of May. In the month of June 42, 40 and 36% increase in basal girth, number of leaves and number of branches were observed under mulch condition compared to no mulch condition.

Mulching can help root growth by maintaining relatively lower rhizosphere temperature, enhancing growth of beneficial macro and micro fauna, besides conserving moisture for a longer period. This may also be the reason for satisfactory plant growth due to mulching apart from conserving soil moisture for longer period. The results obtained is in conformity with the results showed by Zaman *et al.* (1999), Pal *et al.* (2009), Tu *et al.* (2003) and Wang *et al.* (2004). They showed that high microbial biomass and activity often lead to high nutrient availability to crops, through enhancing both the microbial biomass turnover and the degradation of non-microbial organic materials. In other studies conducted by Gupta and Gupta (1983) under arid conditions have shown that organic grass mulching applied to the crop at the rate of 6 t/ha reduced the maximum temperature of soil at 10 cm depth by 1 to 7°C during monsoon season (July to September) and by 4-10°C during summer season (April to June).

Mulching with irrigation showed pronounced effect on plant growth as it was evident from increase in basal diameter and number of leaves during May and June, which are considered to be moisture stressed months. An increase of 46 and 84% in basal diameter and number of leaves per plant, respectively, were

**Table-1:** Variation in soil moisture content (w/w) % over time as affected by different irrigation levels. (Week-wise)

Irrigation intervals	Feb. 1 <sup>st</sup> wk		March 3 <sup>rd</sup> wk		April 2 <sup>nd</sup> wk		April 4 <sup>th</sup> wk		May 2 <sup>nd</sup> wk		May 4 <sup>th</sup> wk	
	$\overline{M_0}$	$\overline{M_1}$	$\overline{M_0}$	$\overline{M_1}$	$\overline{M_0}$	$\overline{M_1}$	$\overline{M_0}$	$\overline{M_1}$	$\overline{M_0}$	$\overline{M_1}$	$\overline{M_0}$	$\overline{M_1}$
Control	14.4	13.7	9.1	9.9	11.0	11.9	11.9	13.4	13.0	13.0	16.9	14.3
15 days	12.1	15.9	11.1	12.4	12.2	14.2	8.3	14.4	8.0	12.9	12.9	9.0
30 days	14.2	14.3	11.9	10.8	12.3	12.9	10.8	13.1	9.6	9.3	13.6	14.1

\*  $M_0$ : No mulch;  $M_1$ : With mulch**Table-2:** Growth characters of *ber* as affected by irrigation and mulching levels.

Treatments	Jan.			May			June		
	Basal Diameter	Plant Height (cm)	No. of Branches (cm)	Basal Diameter	Plant Height (cm)	No. of leaves (cm)	Basal Diameter	Plant Height (cm)	No. of leaves (cm)
<b>Irrigation intervals</b>									
Control	0.64	85.87	12.1	0.89	84.5	87.0	1.25	88.4	231.8
15 days	0.75	90.87	15.5	1.18	84.0	281.7	1.65	100.7	333.1
30 days	0.65	69.25	12.0	0.89	76.37	191.87	1.23	85.8	295.6
SEM $\pm$	0.037	12.1	1.40	0.13	5.59	27.24	0.15	5.56	37.68
CD <sub>(.05)</sub>	NS	81.25*	NS	NS	NS	82.11*	NS	NS	NS
<b>Mulching</b>									
Control	0.70	81.25	11.83	0.80	75.3	116.5	1.14	88.2	238.2
Mulching	0.66	82.7	14.58	1.17	87.91	215.2	1.62	95.2	335.5
SEM $\pm$	0.03	3.27	1.14	0.11	4.57	22.24	0.12	4.54	30.76
CD <sub>(.05)</sub>	NS	NS	NS	0.33*	NS	67.04*	0.37*	NS	92.72*

\*Significant at 5% level

observed due to mulching as compared to no mulch in the month of May. In the month of June 42, 40 and 36% increase in basal diameter, number of leaves and number of branches were observed under mulch conditions compared to no mulch condition. Irrigation alone, without mulching, also showed a substantial increase in case of number of leaves, however, there was none significant difference between basal diameter and number of branches.

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