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**Priyanka Prajapati**  
Department of Fruit Science,  
Horticulture, I.G.K.V. Raipur,  
Chhattisgarh, India

**GD Sahu**  
Department of Fruit Science,  
Horticulture, I.G.K.V. Raipur,  
Chhattisgarh, India

**Manish Prajapati**  
Department of Fruit Science,  
Horticulture, I.G.K.V. Raipur,  
Chhattisgarh, India

## Studies on effect of fertigation level and response of mulching on growth and yield parameters of papaya (*Carica papaya* L.) under Chhattisgarh plains

Priyanka Prajapati, GD Sahu and Manish Prajapati

### Abstract

A field experiment was conducted to “studies on effect of fertigation and response of mulching on growth and yield parameters of papaya (*Carica papaya* L.) under Chhattisgarh plains.” during the year 2015-16 in winter season at Horticulture Instructional-cum- Research Farm, Precision Farming Development Centre (PFDC) IGKV, Raipur (Chhattisgarh). The experiment was laid out in a randomized block design with twelve treatments combinations and three replications. The experimental plots were treated with three fertigation levels 60, 80, and 100% RDF and different mulching materials consisting of silver plastic, organic and without mulch. The plant height, petiole length, stem girth, initiation of flowering, number of fruits, fruit weight, yield plant<sup>-1</sup> and yield ha<sup>-1</sup> increased with fertigation level and mulching. Highest fruit yield plant<sup>-1</sup> was recorded in plastic mulch with 100% RDF (28.29kg) followed by (26.31kg) in plastic mulch with 80% RDF and lowest fruit yield was recorded in control treatment (14.94kg). Under fertigation experiment highest fruit yield ha<sup>-1</sup> was recorded in 100% RDF using plastic mulch, vermiwash and neem seed extract (87.31MT) followed by 80% RDF using plastic mulch, vermiwash and neem seed extract (82.53MT) and lowest fruit yield ha<sup>-1</sup> was found in conventional irrigation system.

**Keywords:** Fertigation, papaya, drip irrigation

### Introduction

Papaya (*Carica papaya* L.) is one of the most important tropical fruit crops of India ranks after mango, banana, and citrus. It belongs to the family Caricaceae, which comprises 20 species in six genera. Badillo (2000) [3] placed papaya as a monotypic genus transferring its 22 closest relatives to an older taxon, *Vasconcellea*. Papaya is a polygamous species, which have three basic sex, staminate (male), pistillate (female), and hermaphrodite (bisexual). Out of these only female is stable and flowers of male and hermaphrodite vary in sex expression under different climatic situations (Litz, 2005) [7]. The current area under papaya cultivation is 1.33 lakh ha (1.80% of total area under fruit crops) and production is around 56.39 lakh tones (6.30% of total production of fruit crops). Gujarat is the leading state in total area (19590 ha.) under papaya cultivation, whereas Andhra Pradesh (15.45 lakh tonnes) leads in total papaya production in India (Anonymous, 2014). Chhattisgarh is the sixth leading producer of papaya in the country with a share of 6%. The production is 3,44,213 MT from an area of 13,055 ha with productivity of 31 MT/ha (Yadav, 2015) [11]. Papaya is also sensitive to water logging condition. So to tackle such situations, improved production technology on papaya such as, water management through drip irrigation, fertigation, crop geometry, plastic mulching and tissue culture techniques etc., have been developed for different agro-climatic regions of the country. (Singh and Singh, 2002) [9]. Mulching is an conventional tool in precision farming cultivation of papaya crops and mulches maintain the soil temperature, restrict the loss of soil moisture, suppress the weed growth, conservation of soil from erosions, reduction of soil salinity, improvement of soil structures, improves water infiltration rate by creating hindrance in flow of water, control of pest and diseases enhance microbial activity in the field. These are key factors which increase plant growth (Singh, 2008) [10] and increasing fruit production (Prasad, 2005; Chattopadhyay, 2007) [8,4].

### Materials and Methods

A Field experiment was carried out at research field of Precision Farming Development centre (PFDC) Department of Fruit Science (Horticulture), IGKV, Raipur (C.G.) during the year 2015-16 in winter season. The experiment was conducted in Randomized Block Design with three replication and twelve treatments combinations. The experimental plots were treated with three fertigation levels 60, 80, and 100 % RDF and different mulching materials consisting

### Correspondence

**Priyanka Prajapati**  
Department of Fruit Science,  
Horticulture, I.G.K.V. Raipur,  
Chhattisgarh, India

of silver plastic mulching, organic mulching and without mulching. Thirty five days old seedlings of papaya were transplanted with keeping row to row and plant to plant spacing 1.8x 1.8 m, respectively.

### Results and Discussion

Results of the experiment revealed that the growth attributing characters of papaya like plant height (179.56cm), was recorded highest in T<sub>11</sub>(100% RDF+ Plastic mulch +Vermiwash+ Neem seed extract) at 270 days after transplanting which was significantly superior over other treatments except *viz.* T<sub>10</sub>(175.45 cm), T<sub>2</sub>(169.55cm) and T<sub>6</sub>(168.64cm) they were at par to treatment T<sub>11</sub>. Stem girth (40.89), was also found maximum under treatment T<sub>11</sub> (100% RDF+ Plastic mulch +Vermiwash+ Neem seed extract) at 270 days after transplanting followed by T<sub>10</sub> (38.42 cm), T<sub>3</sub>(36.85cm) T<sub>6</sub> (35.43cm) and T<sub>2</sub>(35.42cm). However these treatments T<sub>11</sub>, T<sub>10</sub>, T<sub>3</sub>, T<sub>6</sub>, and T<sub>2</sub> were at par to each other, the minimum stem girth was recorded under T<sub>12</sub> (27.72 cm) respectively. Effect of fertigation level and different mulches on petiole length was found highest in T<sub>11</sub>(100% RDF+ Plastic mulch +Vermiwash+ Neem seed extract) at 270 days after transplanting. It was (72.64 cm), highest under treatment T<sub>11</sub> and it was found at par with T<sub>10</sub> (69.90 cm), whereas, the lowest petiole length was recorded under T<sub>12</sub> (53.89 cm) followed by T<sub>7</sub>(54.41cm) respectively. Similar findings were reported by Jeyakumar *et al.*(2010). Minimum days to taken flowering (98.68 days) under treatment T<sub>11</sub> it was followed by other treatment T<sub>10</sub> (80% RDF +Plastic mulch+ Vermiwash+ Neem seed extract) i.e. (103.30 days) and was significantly at par with T<sub>3</sub> taking (107.01) days, *viz.* T<sub>2</sub>(108.08

days),T<sub>1</sub>(109.64 days), T<sub>6</sub>(112.30 days), T<sub>5</sub>(113.84 days), T<sub>4</sub>(114.72 days), T<sub>9</sub>(115.68 days), T<sub>8</sub>(116.87 days), T<sub>7</sub>(118.61 days) and T<sub>12</sub>(128.63days) had been recording delayed flowering in ascending or increasing order. The control or T<sub>12</sub> was the late in flowering taking 128.63 days. Data on yield parameters revealed that the maximum number of fruits per plant (28.11) registered the maximum values when fertigated with 100% RDF+ Plastic mulch +Vermiwash+ Neemseed extract, compared to conventional methods of fertilizer application. Though the number of fruits (28.11) per plant more in T<sub>11</sub> (28.11) followed by T<sub>10</sub> (27.12), T<sub>3</sub> (26.98), T<sub>6</sub> (25.77), T<sub>2</sub> (25.76), T<sub>9</sub> (25.13), T<sub>5</sub> (25.12), and T<sub>1</sub> (24.85), respectively. They were statistically at par to each other. The control T<sub>12</sub> had recorded the lowest fruits per plant (21.63) which was at par to number of treatments *viz.* T<sub>7</sub> (23.89), T<sub>4</sub> (23.99), for character fruit no. per plant.

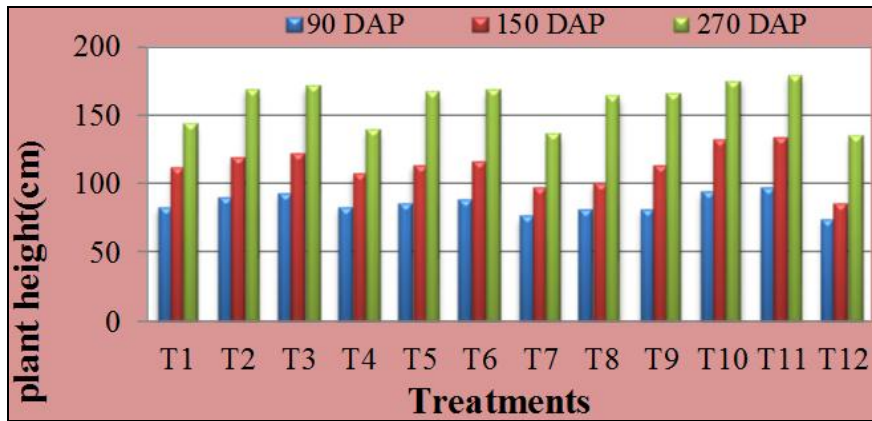
The influence of fertigation on growth attributes and physiological characteristics resulted in higher yield. Maximum fruit weight (1.01kg) was observed high in fertigation with100% RDF+ Plastic mulch+ Vermiwash+ Neemseed extract (Table.2). followed by T<sub>10</sub>(.981kg), T<sub>3</sub>(.912kg), T<sub>6</sub>(.911kg), T<sub>2</sub>(.899kg),T<sub>9</sub>(.890kg) and T<sub>5</sub>(.877kg) respectively they were at par to each other whereas minimum weight of fruit was recorded in T<sub>12</sub> (0.691 kg). The increase in higher fruit weight and number of fruits per plant (28.11kg) resultant total fruit yield per plant (28.29kg plant<sup>-1</sup>).Similar findings were also reported by Agrawal *et al.* (2010). The highest fruit yield ha<sup>-1</sup>(87.31MT) was recorded under treatment T<sub>11</sub>.

**Table 1:** Effect of fertigation and mulching on growth parameters of papaya (*Carica papaya* L.)

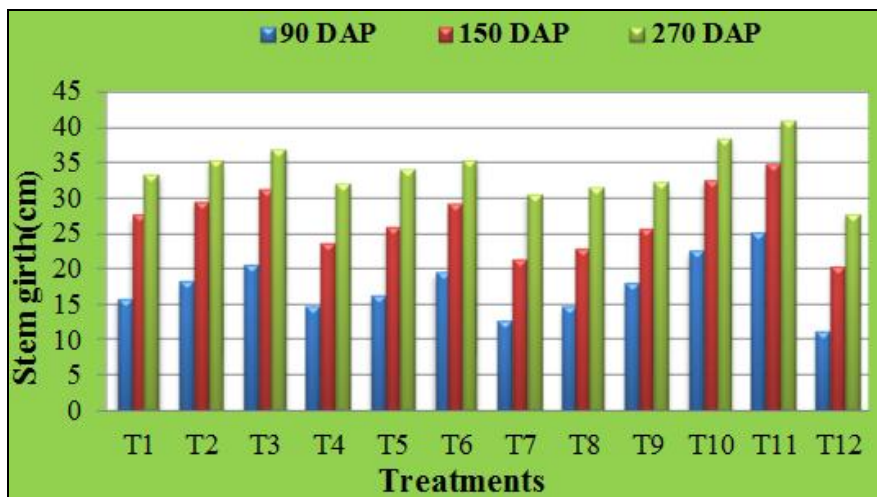
Treatments	Plant height(cm) (270 DAT)	Stem girth(cm) (270 DAT)	Petiole length(cm) (270 DAT)	Initiation of flowering (days)
T <sub>1</sub> 60% RDF+ plastic mulch	143.31	33.30	61.77	109.64
T <sub>2</sub> 80% RDF+ plastic mulch	169.55	35.42	66.70	108.08
T <sub>3</sub> 100% RDF+ plastic mulch	171.24	36.85	67.71	107.01
T <sub>4</sub> 60% RDF+ organic mulch	139.46	32.03	55.67	114.72
T <sub>5</sub> 80% RDF+ organic mulch	167.03	33.92	65.74	113.84
T <sub>6</sub> 100% RDF+ organic mulch	168.64	35.43	66.27	112.30
T <sub>7</sub> 60% RDF+ without mulch	136.56	30.56	54.41	118.61
T <sub>8</sub> 80% RDF+ without mulch	163.89	31.46	62.60	116.87
T <sub>9</sub> 100% RDF+ without mulch	166.11	32.19	65.51	115.68
T <sub>10</sub> 80% RDF+ plastic mulch+Vermiwash +Neem seed extract	175.45	38.42	69.90	103.30
T <sub>11</sub> 100% RDF+plastic mulch+Vermiwash +Neem seed extract	179.56	40.89	72.64	98.68
T <sub>12</sub> Conventional irrigation	134.76	27.72	53.89	128.63
SE (±m)	3.72	1.96	1.30	1.32
CD at 5%	10.93	5.75	3.82	3.88

**Table 2:** Effect of fertigation and mulching on yield parameters of papaya (*Carica papaya* L.)

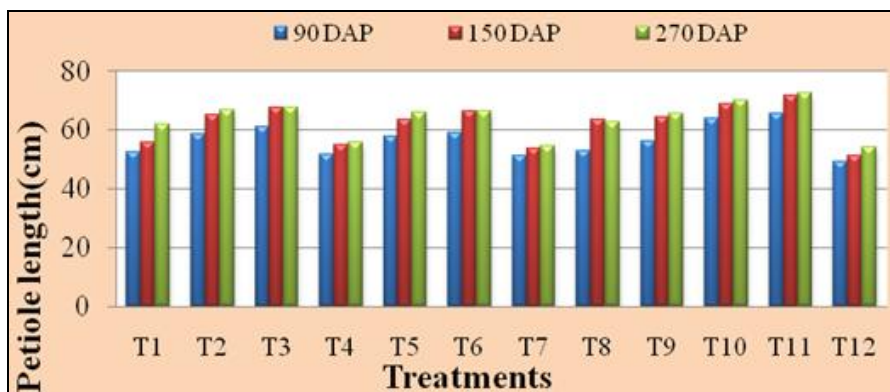
Treatments	No. of fruits plant <sup>-1</sup>	Fruit weight plant <sup>-1</sup> (kg)	Fruit yield plant <sup>-1</sup> (kg)	Fruit yield ha <sup>-1</sup> (MT)
T <sub>1</sub> 60% RDF+ plastic mulch	24.85	0.796	19.79	61.05
T <sub>2</sub> 80% RDF+ plastic mulch	25.76	0.899	23.15	71.47
T <sub>3</sub> 100% RDF+ plastic mulch	26.98	0.912	24.63	75.94
T <sub>4</sub> 60% RDF+ organic mulch	23.99	0.793	19.02	59.08
T <sub>5</sub> 80% RDF+ organic mulch	25.12	0.877	22.03	68.53
T <sub>6</sub> 100% RDF+ organic mulch	25.77	0.911	23.46	71.61
T <sub>7</sub> 60% RDF+ without mulch	23.89	0.712	17.03	52.42
T <sub>8</sub> 80% RDF+ without mulch	24.56	0.798	19.59	60.26
T <sub>9</sub> 100% RDF+ without mulch	25.13	0.890	22.38	69.07
T <sub>10</sub> 80% RDF+ plastic mulch+Vermiwash +NeemN seed extract	27.12	0.981	26.31	82.53
T <sub>11</sub> 100% RDF+plastic mulch+Vermiwash +Neem seed extract	28.11	1.010	28.29	87.31
T <sub>12</sub> Conventional irrigation	21.63	0.691	14.94	46.11
SE (±m)	0.86	0.04	1.86	2.62
CD at 5%	2.54	0.137	5.46	7.69



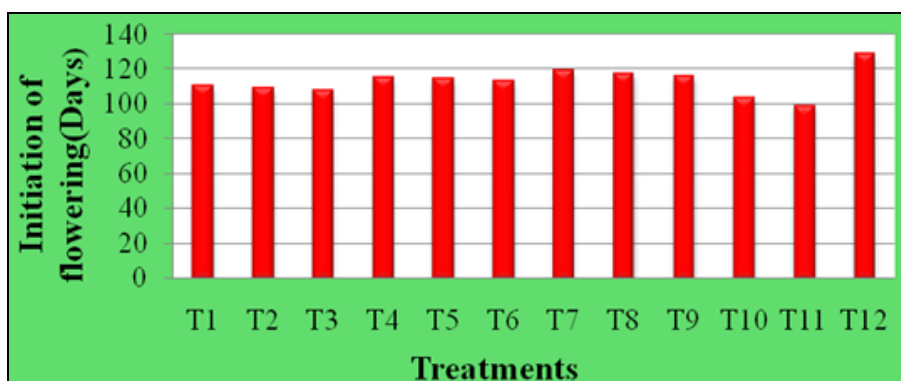
Effect of fertigation levels and mulching on plant height (cm) of papaya



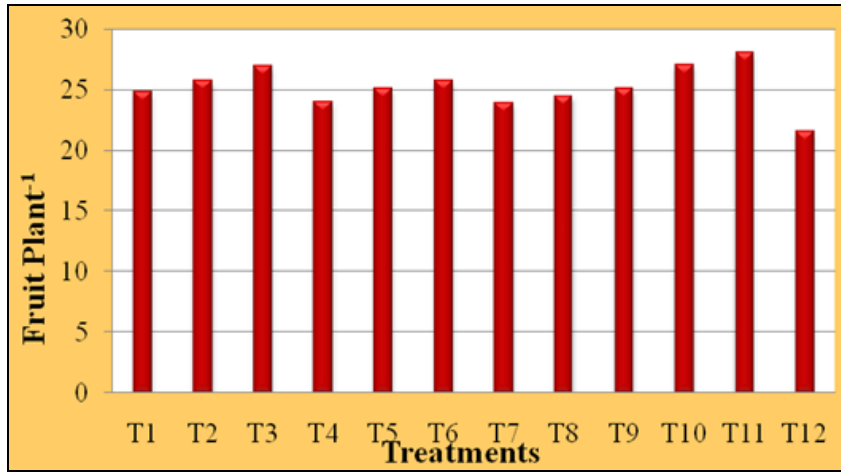
Effect of fertigation levels and mulching on stem girth (cm) of papaya



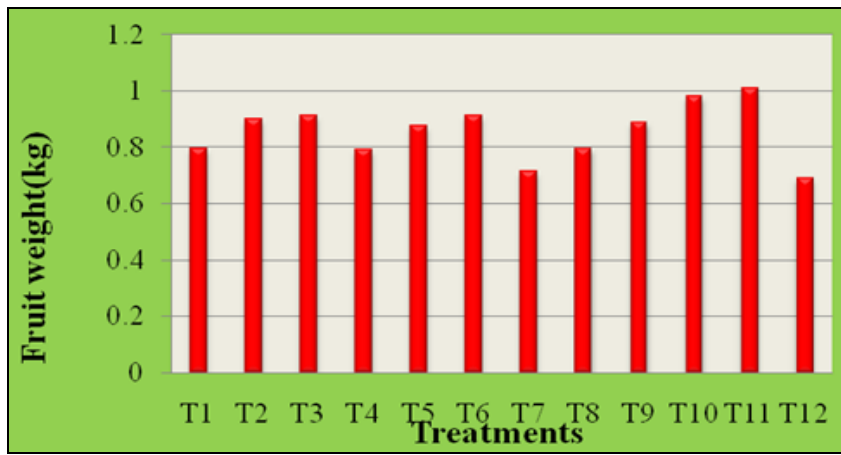
Effect of fertigation levels and mulching on petiole length (cm) of papaya



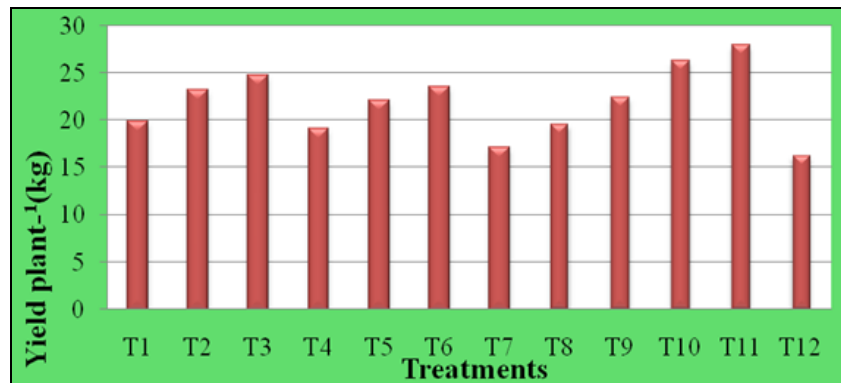
Effect of fertigation levels and mulching on Initiation of flowering(days) of papaya



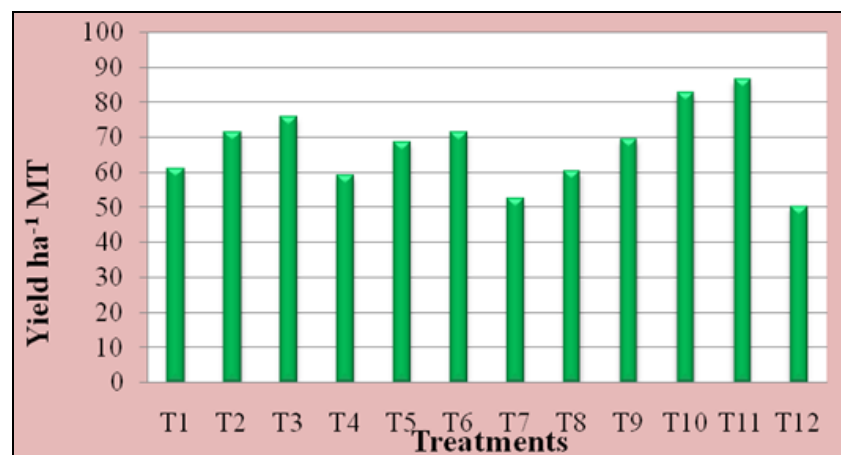
Effect of fertilization levels and mulching on number of fruits plant<sup>-1</sup> of papaya



Effect of fertilization levels and mulching on fruit weight (kg) of papaya



Effect of fertilization levels and mulching on yield plant<sup>-1</sup> (Kg) of papaya



Effect of fertilization levels and mulching on yield ha<sup>-1</sup> (MT) of papaya

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