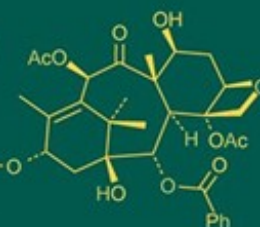
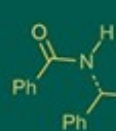


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## Effect of mulching on growth, yield and quality of onion cv. Nasik Dark Red under Bastar plateau zone of Chhattisgarh

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### ABSTRACT

A field experiment was conducted during the rabi season of 2025–26 at the Research cum Instructional Farm of Krantikari Debridhur College of Horticulture and Research Station, Jagdalpur, Bastar, Chhattisgarh, under Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg, Chhattisgarh, to evaluate the effect of eco-friendly mulching materials on growth, yield and post-harvest quality of onion (*Allium cepa* L.) cv. Nasik Dark Red. The experiment comprised ten treatments with three replications in a Randomized Block Design. Each treatment was applied at 6 kg plot<sup>-1</sup> in a plot size of 6 m<sup>2</sup>. Significant variation was observed among treatments for growth, bulb characteristics, yield and quality parameters. Rice straw mulch (T<sub>4</sub>) recorded the maximum plant height at 30, 60 and 90 days after transplanting (DAT), number of leaves, leaf length, equatorial and polar bulb diameter, bulb weight and bulb yield. The maximum bulb yield of 21.21 t ha<sup>-1</sup> was recorded under rice straw mulch, whereas the minimum yield of 8.82 t ha<sup>-1</sup> was recorded in the weedy plot. Vermicompost mulch recorded the highest TSS (14.60 °Brix), while litchi dry leaves mulch recorded the highest dry matter content (13.50%). The study indicated that rice straw mulch was effective in improving growth, bulb development, yield and quality of onion under the experimental conditions of Bastar, Chhattisgarh. The results indicated that rice straw mulch improved vegetative growth, bulb development and yield of onion under the agro-climatic conditions of the Bastar plateau of Chhattisgarh.

**Keywords:** Onion, Eco-friendly mulch, Rice straw, Growth, Bulb yield

### Introduction

Onion (*Allium cepa* L.) is an important bulb vegetable crop cultivated widely for its culinary, nutritional and economic importance. It is commonly known as the “Queen of the Kitchen” and belongs to the family Alliaceae. Onion has a shallow root system and is sensitive to fluctuations in soil moisture, particularly during bulb development. Therefore, maintenance of favourable soil moisture and temperature conditions is important for obtaining higher productivity.

The bulb is the principal edible portion of onion, while green leaves are also consumed. The characteristic pungency of onion is mainly associated with sulphur-containing compounds (McCullum *et al.*, 1976) [1, 2]. In India, onion is an important commercial vegetable crop and is consumed both as a fresh vegetable and in processed forms (Mahajan *et al.*, 2018) [2, 3]. Onion and other *Allium* vegetables are also valued for their vitamins, minerals, antioxidants and other bioactive compounds (Bal *et al.*, 2019) [3, 4].

Mulching is an important cultural practice for conserving soil moisture, moderating soil temperature, suppressing weeds and improving the soil environment around the crop root zone. Organic mulches may additionally contribute organic matter to the soil after decomposition. Several studies have reported beneficial effects of mulching on growth, yield and quality of onion. Prasad *et al.* (2017) [4, 5] reported improvement in growth, bulb development, yield and quality of onion under suitable mulching treatments. Rachel *et al.* (2018) [5, 6] also reported that organic mulches improved soil microclimatic conditions and enhanced plant growth and bulb yield. Akter and Rashid (2022) [6, 7] observed significant effects of organic mulches on growth, bulb characteristics and yield of onion. Tolossa (2020) [7, 8] also reported that mulching influenced onion growth under different irrigation regimes.

The effectiveness of a mulch depends on its physical characteristics, decomposition behaviour, moisture-conservation capacity and local availability. Therefore, evaluation of locally available organic materials is important for developing economical and environmentally sustainable production practices. Hence, the present investigation was conducted to assess the effect of different eco-friendly mulching materials on growth, yield and post-harvest quality of onion cv. Nasik Dark Red under the Bastar plateau conditions of Chhattisgarh.

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## Materials and methods

The experiment was conducted during the rabi season of 2025–26 at the Research cum Instructional Farm of Krantikari Debridhur College of Horticulture and Research Station, Jagdalpur, Bastar, Chhattisgarh. The experimental field was located at 19.10255° N latitude and 81.991215° E longitude, as recorded using GPS during the experimental period. Under Mahatma Gandhi Udyanikkee Evam Vanikkee Vishwavidyalaya, Durg, Chhattisgarh. The experiment was conducted using onion (*Allium cepa* L.) cv. Nasik Dark Red. The total experimental area was 245 m<sup>2</sup> (24.5 m × 10 m). The experiment comprised ten treatments with three replications, resulting in 30 experimental plots. Each plot measured 3 m × 2 m with a net plot area of 6 m<sup>2</sup>. The crop was planted at a spacing of 20 cm × 10 cm between rows and plants, respectively. The experiment was laid out in a Randomized Block Design. Ten treatments comprising different eco-friendly organic mulching materials, a weed-free control and a weedy plot were evaluated. The treatments were: T<sub>1</sub>: Control (weed-free), T<sub>2</sub>: Litchi dry leaves mulch @ 6 kg plot<sup>-1</sup>, T<sub>3</sub>: Coffee peel mulch @ 6 kg plot<sup>-1</sup>, T<sub>4</sub>: Rice straw mulch @ 6 kg plot<sup>-1</sup>, T<sub>5</sub>: Weedy plot, T<sub>6</sub>: Vermicompost mulch @ 6 kg plot<sup>-1</sup>, T<sub>7</sub>: Weed mulch @ 6 kg plot<sup>-1</sup>, T<sub>8</sub>: Sawdust mulch @ 6 kg plot<sup>-1</sup>, T<sub>9</sub>: Banana leaves mulch @ 6 kg

plot<sup>-1</sup>, and T<sub>10</sub>: Neem leaves mulch @ 6 kg plot<sup>-1</sup>. The organic mulching materials were applied @ 6 kg plot<sup>-1</sup>. Mulching was carried out after the second irrigation when the soil moisture reached a suitable minimum level. Gap filling was completed before mulch application. The recommended dose of fertilizers comprising 100 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 50 kg K<sub>2</sub>O ha<sup>-1</sup> was applied through urea, diammonium phosphate and muriate of potash. Other cultural practices were followed uniformly for all treatments. The crop was harvested when approximately 50 per cent of the tops had fallen and dried. After harvesting, bulbs were cured for 3–4 days and a neck length of approximately 2.5 cm was retained. Observations recorded growth parameters including plant height, number of leaves per plant and leaf length were recorded at 30, 60 and 90 DAT. Yield attributes including shoot weight 100 DAT equatorial diameter, polar diameter, bulb weight, neck thickness and bulb yield were recorded at harvest. The experimental data were analysed statistically using the procedures applicable to a Randomized Block Design. The significance of treatment differences was tested at the 5 per cent probability level. The critical difference (CD) and standard error of mean (SEm ±) were used for comparison of treatment means.

## Data collection and mathematical formulae

$$\text{Moisture (\%)} = \left[ \frac{\text{Fresh Weight} - \text{Dry Weight}}{\text{Fresh Weight}} \right] \times 100$$

$$\text{Dry matter content (\%)} = \left[ \frac{\text{Dry weight of sample}}{\text{Fresh weight of sample}} \right] \times 100$$

## Results and discussion

### 1. Growth parameters

**Plant height-** Significant differences were observed among the treatments for plant height at 30, 60 and 90 DAT (Table 1). At 30 DAT, plant height ranged from 21.32 to 29.34 cm. The maximum plant height (29.34 cm) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>2</sub> (28.05 cm), T<sub>6</sub> (26.73 cm) and T<sub>7</sub> (26.58 cm). The minimum plant height (21.32 cm) was recorded in T<sub>5</sub>: Weedy plot. At 60 DAT, plant height ranged from 29.86 to 44.50 cm. The maximum plant height (44.50 cm) was recorded in T<sub>4</sub> which was statistically at par with T<sub>2</sub> (42.13 cm), T<sub>6</sub> (41.03 cm) and T<sub>9</sub> (39.20 cm). The minimum plant height (29.86 cm) was recorded in T<sub>5</sub>. At 90 DAT, plant height ranged from 48.50 to 66.00 cm. The maximum plant height (66.00 cm) was recorded in T<sub>4</sub> which was statistically at par with T<sub>6</sub> (61.40 cm), T<sub>8</sub> (60.90 cm) and T<sub>2</sub> (59.90 cm). The minimum plant height (48.50 cm) was recorded in T<sub>5</sub>.

The increased plant height under mulching treatments may be attributed to improved soil moisture conservation, moderation of soil temperature and reduction in weed competition, which created favourable conditions for root activity and vegetative growth. In contrast, unrestricted weed growth in T<sub>5</sub> probably increased competition for moisture, nutrients, light and other resources, resulting in reduced plant growth. Similar findings were reported by Masalkar *et al.* (2014) [8, 9], Rachel *et al.* (2018) [5, 6], Prasad *et al.* (2017) [4, 5] and Karangiya *et al.* (2023) [9, 10].

**Number of leaves per plant-** Significant differences were observed among the treatments for number of leaves per plant at all three observation stages (Table 1). At 30 DAT, the number of leaves ranged from 3.00 to 4.97. The maximum number of leaves (4.97) was recorded in T<sub>4</sub> followed by T<sub>10</sub> (4.27) and T<sub>2</sub> (4.11), whereas the minimum number of leaves (3.00) was recorded in T<sub>1</sub>. At 60 DAT, the number of leaves ranged from 4.20 to 7.59. The maximum number of leaves (7.59) was recorded in T<sub>4</sub> which was statistically at par with T<sub>6</sub> (7.50) and T<sub>2</sub> (7.39). The minimum number of leaves (4.20) was recorded in T<sub>5</sub>. At 90 DAT, the number of leaves ranged from 6.72 to 11.69. The maximum number of leaves (11.69)

was recorded in T<sub>4</sub>, which was statistically at par with T<sub>6</sub> (11.08), T<sub>2</sub> (10.27) and T<sub>10</sub> (10.22). The minimum number of leaves (6.72) was recorded in T<sub>5</sub>. The increase in leaf production under rice straw mulch may be related to improved soil moisture availability and favourable soil temperature, which enhanced nutrient uptake and vegetative development. Similar improvements in onion growth under organic mulching have been reported by Rachel *et al.* (2018) [5, 6] and Akter and Rashid (2022) [6, 7].

**Leaf length-** Significant variation was observed among the treatments for leaf length at 30, 60 and 90 DAT (Table 1), Fig. 1.1. At 30 DAT, leaf length ranged from 19.20 to 27.80 cm. The maximum leaf length (27.80 cm) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>2</sub> (27.30 cm), T<sub>6</sub> (25.32 cm) and T<sub>7</sub> (24.60 cm). The minimum leaf length (19.20 cm) was recorded in T<sub>5</sub>: Weedy plot. At 60 DAT, leaf length ranged from 26.04 to 39.35 cm. The maximum leaf length (39.35 cm) was recorded in T<sub>4</sub>: Rice straw mulch, which was statistically at par with T<sub>2</sub> (38.96 cm) and T<sub>6</sub> (39.06 cm). The minimum leaf length (26.04 cm) was recorded in T<sub>5</sub>: Weedy plot. At 90 DAT, leaf length ranged from 31.40 to 54.54 cm. The maximum leaf length (54.54 cm) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>2</sub> (53.58 cm) and T<sub>6</sub> (51.04 cm). The minimum leaf length (31.40 cm) was recorded in T<sub>5</sub>: Weedy plot. The favourable response of leaf growth under rice straw mulch may be attributed to better conservation of soil moisture and reduced fluctuations in soil temperature, which promoted vegetative growth. Similar results were reported by Prasad *et al.* (2017) [4, 5] and Rachel *et al.* (2018) [5, 6].

### 2. Yield attributes and bulb yield

**Equatorial diameter-** The equatorial diameter of bulbs ranged from 48.50 to 66.02 mm bulb<sup>-1</sup>, with a grand mean of 57.41 mm bulb<sup>-1</sup> (Table 2). The maximum equatorial diameter (66.02 mm bulb<sup>-1</sup>) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>9</sub> (63.90 mm bulb<sup>-1</sup>), T<sub>8</sub> (60.90 mm bulb<sup>-1</sup>), T<sub>6</sub> (60.01 mm bulb<sup>-1</sup>) and T<sub>2</sub> (59.90 mm bulb<sup>-1</sup>). The minimum equatorial diameter (48.50 mm bulb<sup>-1</sup>) was recorded in T<sub>5</sub>.

**Polar diameter-** The polar diameter ranged from 49.47 to 59.60 mm bulb<sup>-1</sup>. The maximum polar diameter (59.60 mm bulb<sup>-1</sup>) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>10</sub> (59.33 mm bulb<sup>-1</sup>), T<sub>9</sub> (57.60 mm bulb<sup>-1</sup>), T<sub>6</sub> (56.67 mm bulb<sup>-1</sup>), T<sub>1</sub> (55.32 mm

bulb<sup>-1</sup>), T<sub>3</sub> (55.20 mm bulb<sup>-1</sup>) and T<sub>8</sub> (54.33 mm bulb<sup>-1</sup>). The minimum polar diameter (49.47 mm bulb<sup>-1</sup>) was recorded in T<sub>5</sub>.

**Bulb weight-** Bulb weight ranged from 49.50 to 87.10 g plant<sup>-1</sup>, with a grand mean of 74.43 g plant<sup>-1</sup>. The maximum bulb weight (87.10 g plant<sup>-1</sup>) was recorded in T<sub>4</sub> which was statistically at par with T<sub>6</sub> (84.16 g plant<sup>-1</sup>), T<sub>9</sub> (81.83 g plant<sup>-1</sup>), T<sub>10</sub> (79.04 g plant<sup>-1</sup>) and T<sub>1</sub> (78.56 g plant<sup>-1</sup>). The minimum bulb weight (49.50 g plant<sup>-1</sup>) was recorded in T<sub>5</sub>. The improved bulb weight under mulching treatments may be associated with better growing conditions and enhanced assimilate accumulation. Similar beneficial effects of mulching on fresh and dry bulb weight were reported in garlic by Rai and Negi (2021) [10, 11].

**Shoot weight at 100 DAT-** Shoot wet weight ranged from 35.10 to 87.53 g plant<sup>-1</sup>. The maximum shoot wet weight (87.53 g plant<sup>-1</sup>) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>6</sub> (86.76 g plant<sup>-1</sup>), T<sub>2</sub> (85.87 g plant<sup>-1</sup>) and T<sub>9</sub> (83.42 g plant<sup>-1</sup>). The minimum shoot wet weight (35.10 g plant<sup>-1</sup>) was recorded in T<sub>5</sub>. The higher shoot biomass under mulching treatments may be associated with better soil moisture conservation and reduced weed competition, which favoured vegetative growth and biomass accumulation. Similar improvement in shoot weight under mulching treatments in onion was reported by Magar *et al.* (2024) [11, 12].

**Neck thickness-** Neck thickness ranged from 8.30 to 13.30 mm. The maximum neck thickness (13.30 mm) was recorded in T<sub>6</sub>, which was statistically at par with T<sub>10</sub> (11.80 mm), whereas the minimum neck thickness (8.30 mm) was recorded in T<sub>5</sub>. The increased neck thickness under vermicompost mulch may be related to improved nutrient availability and favourable soil conditions that promoted vegetative growth. Similar improvement in onion growth and yield with vermicompost application has been reported by Monira *et al.* (2019) [12, 13].

**Bulb yield (kg plot<sup>-1</sup>)-** Bulb yield ranged from 5.29 to 12.73 kg plot<sup>-1</sup>. The maximum bulb yield (12.73 kg plot<sup>-1</sup>) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>9</sub> (12.34 kg plot<sup>-1</sup>), T<sub>10</sub> (11.76 kg plot<sup>-1</sup>), T<sub>6</sub> (11.46 kg plot<sup>-1</sup>) and T<sub>1</sub> (11.39 kg plot<sup>-1</sup>). The minimum bulb yield (5.29 kg plot<sup>-1</sup>) was recorded in T<sub>5</sub>.

**Bulb yield (t ha<sup>-1</sup>)-** Bulb yield ranged from 8.82 to 21.21 t ha<sup>-1</sup>, with a grand mean of 17.35 t ha<sup>-1</sup>. The maximum bulb yield (21.21 t ha<sup>-1</sup>) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>9</sub> (20.56 t ha<sup>-1</sup>), T<sub>10</sub> (19.61 t ha<sup>-1</sup>), T<sub>6</sub> (19.10 t ha<sup>-1</sup>) and T<sub>1</sub> (18.99 t ha<sup>-1</sup>). The minimum bulb yield (8.82 t ha<sup>-1</sup>) was recorded in T<sub>5</sub>. The higher bulb yield under rice straw mulch may be attributed to favourable soil microclimatic conditions created by the mulch. The mulch layer likely reduced soil moisture loss, moderated soil temperature and suppressed weed growth, thereby improving water and nutrient availability. Better vegetative growth would have increased photosynthetic activity and assimilate production, while improved bulb diameter and bulb weight contributed directly to higher bulb yield. In contrast, unrestricted weed competition in T<sub>5</sub> may have reduced the availability of moisture, nutrients and light, resulting in poor bulb development and lower yield. Similar findings were reported by Prasad *et al.* (2017) [4, 5], Rachel *et al.* (2018) [5, 6] and Singh *et al.* (2018) [13, 14].

### 3. Results and Discussion

#### Post-harvest quality parameters

**Moisture content-** Significant differences were observed among treatments for bulb moisture content (Table 3). Moisture content ranged from 86.50 to 89.90 per cent. The minimum moisture content (86.50%) was recorded in T<sub>2</sub> – Litchi dry leaves mulch, which was statistically at par with T<sub>8</sub> (87.40%), T<sub>6</sub> (87.50%) and T<sub>3</sub> (87.63%). The maximum moisture content (89.90%) was recorded in T<sub>5</sub>. The variation in bulb moisture

content may be associated with differences in crop growth, bulb development and moisture regulation under the different mulch environments. Lower moisture content at harvest may be favourable for curing and storage stability because excessive moisture can increase the risk of deterioration during storage. Islam *et al.* (2019) [14, 15] emphasized the importance of temperature and relative humidity conditions in maintaining onion bulb quality during storage.

**Dry matter-** The dry matter content varied from 10.10 to 13.50 percent. The maximum dry matter content was recorded in T<sub>2</sub> (13.50%), which was statistically at par with T<sub>8</sub> (12.60%), T<sub>6</sub> (12.50%) and T<sub>3</sub> (12.37%). The minimum dry matter content was observed in T<sub>5</sub> (10.10%). The higher dry matter accumulation under mulched treatments may be attributed to more favourable soil moisture conditions and improved plant growth, which could have enhanced photosynthesis and translocation of assimilates towards the bulbs. Similar observations were reported by Karangiya *et al.* (2023) [9, 10], who found significant improvement in dry matter content of onion bulbs under mulching treatments. The higher dry matter content under the mulching treatments might be attributed to improved soil moisture conservation and favourable soil conditions. Similar findings were reported by Kabir *et al.* (2016) [15, 16], who observed improved growth and dry matter accumulation under rice straw mulch in rice.

**Total soluble solids-** TSS ranged from 10.90 to 14.60 °Brix. The maximum TSS (14.60 °Brix) was recorded in T<sub>6</sub>, which was statistically at par with T<sub>4</sub> (14.40 °Brix), T<sub>8</sub> (14.20 °Brix), T<sub>2</sub> (13.80 °Brix) and T<sub>9</sub> (13.40 °Brix). The minimum TSS (10.90 °Brix) was recorded in T<sub>5</sub>. The higher TSS under vermicompost mulch may be associated with improved nutrient availability and better plant growth, which enhanced photosynthate production and accumulation of soluble solids in the bulbs. Similar variation in TSS of onion bulbs under different mulching treatments has been reported by Karangiya *et al.* (2023) [9, 10].

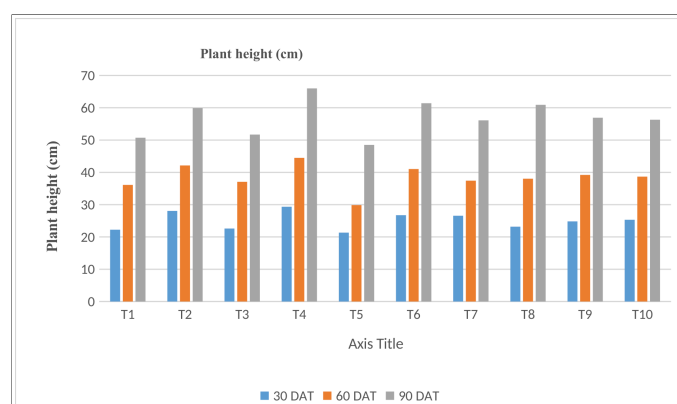


Figure 1.1. Effect of on Plant height (cm) at 30, 60 and 90

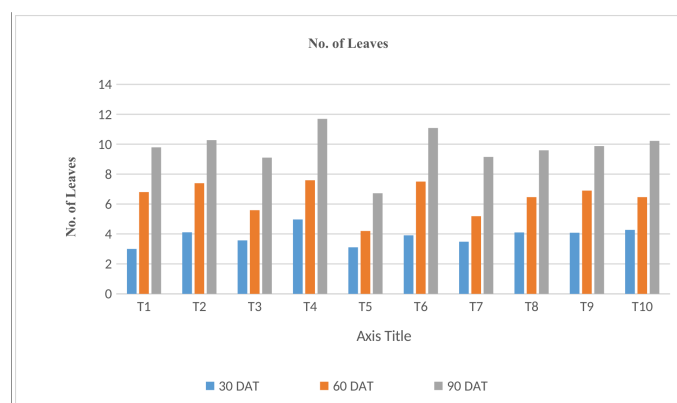


Figure 1.2. Effect on no. of leaves per plant at 30, 60 and 90 days

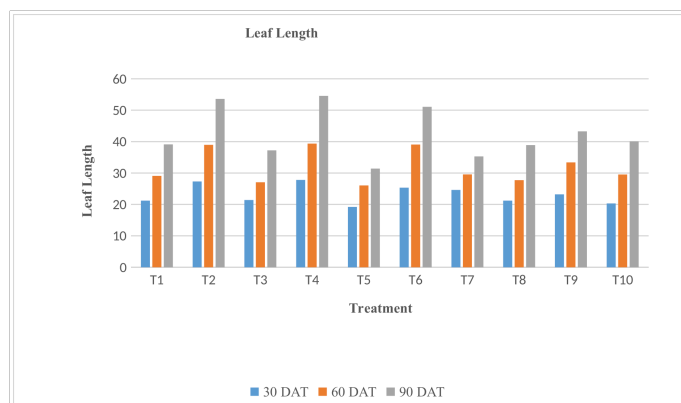


**Figure 1.3.** Effect on leaves length per plant at 30, 60 and 90 DAT

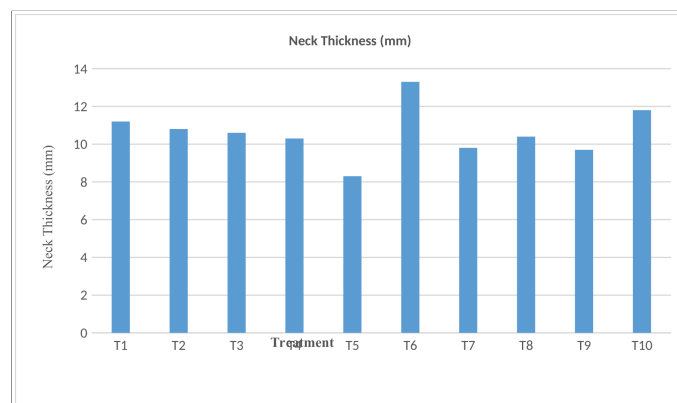


**Figure 2.4.** Effect of mulching on neck thickness

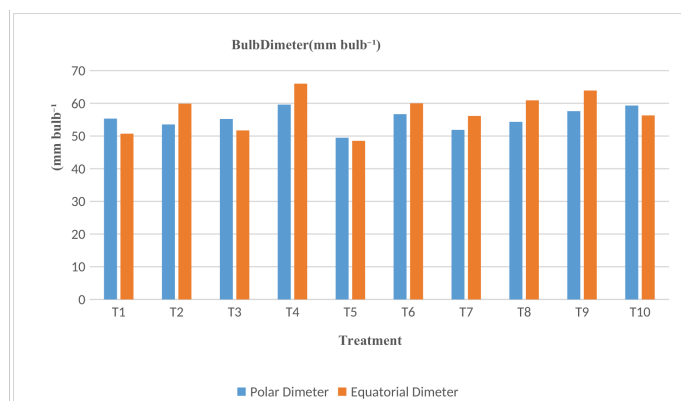


**Figure 2.1.** Effect of eco-friendly mulching on bulb diameter

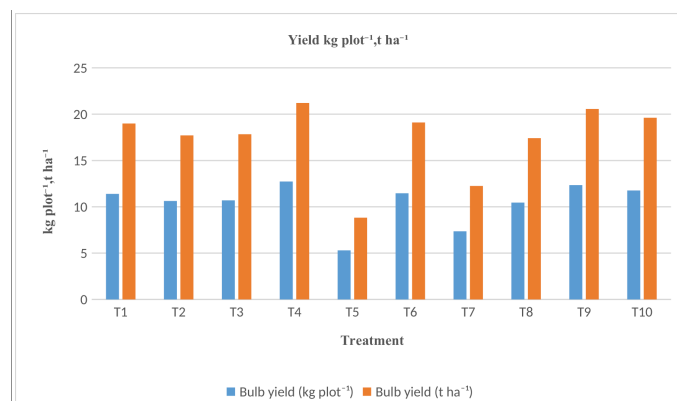


**Figure 2.5.** Effect of mulching on bulb yield

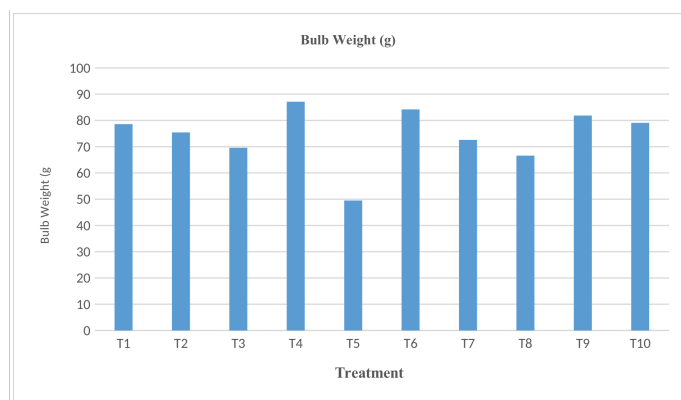


**Figure 2.2.** Effect of mulching on bulb weight

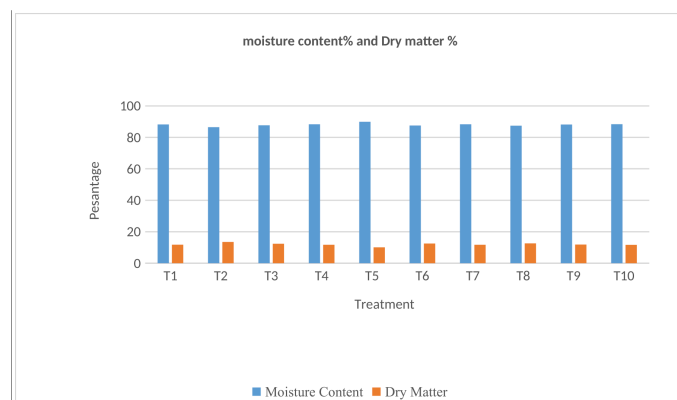


**Figure 3.1.** Effect of mulching on moisture content and dry matter



**Figure 2.3.** Effect of mulching on shoot weight

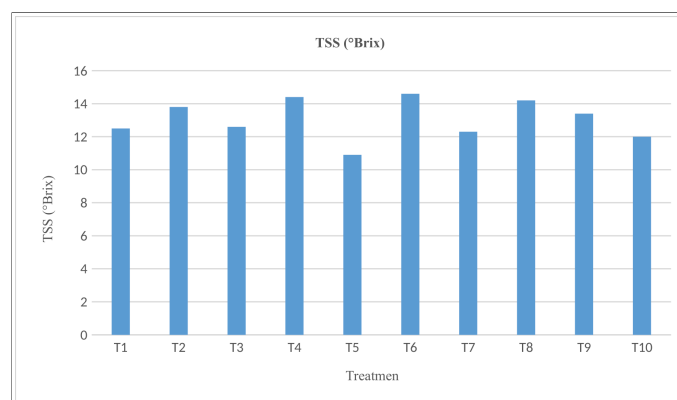


**Figure 3.2.** Effect of mulching on TSS

**Table 1.** Effect of eco-friendly mulching materials on Plant height, number of leaves, leaves length per plant at 30, 60 and 90 DAT after transplanting

| Treatments                           | Height of plant (cm) |        |        | No. of Leaves |        |        | Leaf Length (cm) |        |        |
|--------------------------------------|----------------------|--------|--------|---------------|--------|--------|------------------|--------|--------|
|                                      | 30 DAT               | 60 DAT | 90 DAT | 30 DAT        | 60 DAT | 90 DAT | 30 DAT           | 60 DAT | 90 DAT |
| T <sub>1</sub> - Control (Weed-free) | 22.24                | 36.10  | 50.7   | 3.00          | 6.80   | 9.79   | 21.20            | 29.08  | 39.12  |
| T <sub>2</sub> - Litchi dry leaves   | 28.05                | 42.13  | 59.9   | 4.11          | 7.39   | 10.27  | 27.30            | 38.96  | 53.58  |
| T <sub>3</sub> - Coffee peel         | 22.61                | 37.06  | 51.7   | 3.57          | 5.59   | 9.10   | 21.40            | 27.06  | 37.20  |
| T <sub>4</sub> - Rice straw mulch    | 29.34                | 44.50  | 66.0   | 4.97          | 7.59   | 11.69  | 27.80            | 39.35  | 54.54  |
| T <sub>5</sub> - Weedy plot          | 21.32                | 29.86  | 48.5   | 3.11          | 4.20   | 6.72   | 19.20            | 26.04  | 31.4   |
| T <sub>6</sub> - Vermicompost mulch  | 26.73                | 41.03  | 61.4   | 3.91          | 7.50   | 11.08  | 25.32            | 39.06  | 51.04  |
| T <sub>7</sub> - Weed mulch          | 26.58                | 33.43  | 56.1   | 3.48          | 5.19   | 9.15   | 24.60            | 29.54  | 35.27  |
| T <sub>8</sub> - Saw dust mulch      | 23.18                | 38.03  | 60.9   | 4.10          | 6.46   | 9.59   | 21.20            | 27.72  | 38.88  |
| T <sub>9</sub> - Banana leaves       | 24.82                | 39.20  | 56.9   | 4.08          | 6.90   | 9.87   | 23.20            | 33.37  | 43.26  |
| T <sub>10</sub> - Neem leaves        | 25.31                | 38.66  | 56.3   | 4.27          | 6.46   | 10.22  | 20.30            | 29.52  | 40.04  |
| C.D. ( $P = 0.05$ )                  | 3.21                 | 5.74   | 7.15   | 0.42          | 1.10   | 1.59   | 3.45             | 3.78   | 5.60   |
| SE(m) $\pm$                          | 1.07                 | 1.91   | 2.39   | 0.14          | 0.36   | 0.53   | 1.15             | 1.27   | 1.87   |
| C.V. (%)                             | 7.44                 | 8.74   | 7.28   | 6.32          | 9.94   | 9.48   | 8.63             | 9.70   | 7.63   |

**Table 2.** Yield parameter of onion as influenced by the deferent types of eco-friendly mulches

| Treatment                            | Equatorial diameter (mm bulb <sup>-1</sup> ) | Polar diameter (mm bulb <sup>-1</sup> ) | Bulb weight (g plant <sup>-1</sup> ) | Leaf weight (g plant <sup>-1</sup> ) | Neck thickness (mm) | Bulb yield (kg plot <sup>-1</sup> ) | Bulb yield (t ha <sup>-1</sup> ) |
|--------------------------------------|----------------------------------------------|-----------------------------------------|--------------------------------------|--------------------------------------|---------------------|-------------------------------------|----------------------------------|
| T <sub>1</sub> – Control (Weed-free) | 50.70                                        | 55.32                                   | 78.56                                | 71.97                                | 11.2                | 11.39                               | 18.99                            |
| T <sub>2</sub> – Litchi dry leaves   | 59.90                                        | 53.53                                   | 75.40                                | 85.87                                | 10.8                | 10.63                               | 17.71                            |
| T <sub>3</sub> – Coffee peel mulch   | 51.70                                        | 55.20                                   | 69.56                                | 65.00                                | 10.6                | 10.70                               | 17.83                            |
| T <sub>4</sub> – Rice straw mulch    | 66.02                                        | 59.60                                   | 87.10                                | 87.53                                | 10.3                | 12.73                               | 21.21                            |
| T <sub>5</sub> – Weedy plot          | 48.50                                        | 49.47                                   | 49.50                                | 35.10                                | 8.3                 | 5.293                               | 8.82                             |
| T <sub>6</sub> – Vermicompost mulch  | 60.01                                        | 56.67                                   | 84.16                                | 86.76                                | 13.3                | 11.46                               | 19.10                            |
| T <sub>7</sub> – Weed mulch          | 56.13                                        | 51.87                                   | 72.56                                | 37.90                                | 9.8                 | 07.35                               | 12.25                            |
| T <sub>8</sub> – Saw dust mulch      | 60.90                                        | 54.33                                   | 66.56                                | 68.00                                | 10.4                | 10.45                               | 17.41                            |
| T <sub>9</sub> – Banana leaves mulch | 63.90                                        | 57.60                                   | 81.83                                | 83.42                                | 9.7                 | 12.34                               | 20.56                            |
| T <sub>10</sub> – Neem leaves mulch  | 56.30                                        | 59.33                                   | 79.04                                | 58.46                                | 11.8                | 11.76                               | 19.61                            |
| CD ( $P = 0.05$ )                    | 8.97                                         | 6.04                                    | 8.77                                 | 12.18                                | 1.736               | 1.74                                | 2.90                             |
| SE(m) $\pm$                          | 2.99                                         | 2.017                                   | 2.93                                 | 4.06                                 | 0.58                | 0.58                                | 0.96                             |
| CV (%)                               | 9.039                                        | 6.319                                   | 6.823                                | 10.362                               | 6.431               | 9.67                                | 9.67                             |

**Table 3.** Effect of eco-friendly mulching materials on TSS, Moisture and Dry Matter of Onion

| Treatment                            | Moisture Content | Dry Matter | TSS (°Brix) |
|--------------------------------------|------------------|------------|-------------|
| T <sub>1</sub> - Control (Weed-free) | 88.23            | 11.77      | 12.5        |
| T <sub>2</sub> - Litchi dry leaves   | 86.5             | 13.5       | 13.8        |
| T <sub>3</sub> - Coffee peel         | 87.63            | 12.37      | 12.6        |
| T <sub>4</sub> - Rice straw mulch    | 88.27            | 11.73      | 14.4        |
| T <sub>5</sub> - Weedy plot          | 89.9             | 10.1       | 10.9        |
| T <sub>6</sub> - Vermicompost mulch  | 87.5             | 12.5       | 14.6        |
| T <sub>7</sub> - Weed mulch          | 88.27            | 11.73      | 12.3        |
| T <sub>8</sub> - Saw dust mulch      | 87.4             | 12.6       | 14.2        |
| T <sub>9</sub> - Banana leaves       | 88.13            | 11.87      | 13.4        |
| T <sub>10</sub> - Neem leaves        | 88.33            | 11.67      | 12          |
| C.D. ( $P = 0.05$ )                  | 1.625            | 1.626      | 1.91        |
| S.Em. ( $\pm$ )                      | 0.543            | 0.543      | 0.638       |
| C.V. (%)                             | 1.068            | 7.848      | 8.454       |

## Conclusion

The present study demonstrated that different eco-friendly mulching materials significantly influenced the growth, bulb development, yield and post-harvest quality of onion cv. Nasik Dark Red under the Bastar

plateau conditions of Chhattisgarh. Rice straw mulch (T<sub>4</sub>) recorded the highest plant height, number of leaves, leaf length, equatorial diameter, polar diameter, bulb weight and bulb yield, with a maximum bulb yield of 21.21 t ha<sup>-1</sup>. Vermicompost mulch (T<sub>6</sub>) recorded the highest total soluble solids (14.60 °Brix), whereas litchi dry leaves

mulch (T<sub>2</sub>) recorded the highest dry matter content (13.50%). In contrast, the weedy plot generally recorded the lowest values for growth, bulb characteristics and yield.

Among the evaluated treatments, rice straw mulch showed considerable potential for improving onion growth, bulb development and productivity under the experimental conditions. Therefore, rice straw mulch may be considered a promising eco-friendly mulching option for onion cv. Nasik Dark Red under the Bastar plateau conditions of Chhattisgarh. Further evaluation over multiple seasons and locations would help to validate its consistency and economic suitability.

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