

Table 4 Effect of mulching treatments on yield and yield-related parameters of onion (*Allium cepa* L.) at harvest

Treatments	Stem Dia. (cm)	Bulb Wt. (g)	Bulb length (cm)	Bulb Dia. (cm)	Root length (cm)	Total yield (t/ha)
Control	0.89c	61.72e	4.28c	5.21d	10.38a	18.42d
Banana leaf mulch	1.11b	80.93cd	4.73bc	5.79cd	9.76a	22.14c
Sawdust mulch	1.06b	76.58d	5.19a	5.91bc	10.09a	23.87c
Rice straw mulch	1.28a	95.84b	4.97ab	6.53ab	10.68a	29.54b
Plastic mulch	1.41a	111.47a	4.83b	7.08a	11.14a	35.27a
LSD ($p \leq 0.05$)	0.19***	9.7***	0.33***	0.61*	1.97 ns	2.9***
CV (%)	5.92	6.24	3.82	5.17	10.91	5.86
Grand mean	1.15	85.31	4.80	6.10	10.41	25.85

Note: Means in a column followed by different lowercase letters differ significantly at $p \leq 0.05$ (DMRT). * $p \leq 0.05$; *** $p \leq 0.001$; ns: not significant. LSD: least significant difference; CV: coefficient of variation; Stem Dia.: stem diameter; Bulb Wt.: bulb weight; Bulb Dia.: bulb diameter

3.4.1 Stem diameter

Plastic mulch produced the widest stem diameter (1.41 cm), followed by rice straw mulch (1.28 cm), while the control recorded the smallest (0.89 cm). Pseudostem girth is closely correlated with overall plant vigor, vascular bundle density, and capacity for water and solute transport to the bulb (Ahmad et al., 2022). Banana leaf and sawdust mulches produced intermediate values (1.11 and 1.06 cm, respectively), reflecting their lower thermal insulation and slower nutrient contribution relative to plastic and straw mulches.

3.4.2 Bulb weight

Fresh bulb weight differed significantly among treatments ($p < 0.001$). Plastic mulch achieved the highest value (111.47 g), followed by rice straw mulch (95.84 g), banana leaf mulch (80.93 g), sawdust mulch (76.58 g), and the control (61.72 g). The 80.7% increase in bulb weight under plastic mulch relative to the control underscores the critical importance of consistent moisture supply and thermal regulation during the bulbing phase. These results corroborate Islam et al. (2007) and Najafabadi et al. (2012), who documented substantial bulb weight advantages under polyethylene mulch. The competitive performance of rice straw mulch reflects the combined benefit of moisture conservation and gradual nitrogen supply during storage organ filling.

3.4.3 Bulb length and diameter

Sawdust mulch produced the longest bulbs (5.19 cm), though statistically at par with rice straw mulch (4.97 cm). Elongated bulb form under sawdust is attributable to its high porosity and low bulk density when applied as mulch, improving aeration and reducing mechanical resistance to radial bulb expansion (Haque et al., 2003). Bulb diameter was greatest under plastic mulch (7.08 cm), followed by rice straw mulch (6.53 cm), and was lowest in the control (5.21 cm). Equatorial diameter is a primary determinant of commercial grade in onion markets, making the plastic mulch advantage economically significant (Najafabadi et al., 2012).

3.4.4 Total yield

Total fresh yield showed the strongest treatment differentiation (Table 4). Plastic mulch yielded 35.27 t/ha 91.5% advantage over the control (18.42 t/ha)—and was significantly superior to all other treatments. Rice straw mulch (29.54 t/ha) was the next highest, statistically distinct from banana leaf mulch (22.14 t/ha), sawdust mulch (23.87 t/ha), and the control. The superior yield under plastic mulch is a cumulative outcome of consistently higher leaf area index, improved photosynthetic duration, enhanced nutrient uptake efficiency, and reduced weed competition across the entire growth cycle (Lamont, 2005; El-Beltagi et al., 2022). The yield hierarchy plastic > rice straw > sawdust > banana leaf > control is consistent with reports from comparable subtropical environments (Ramakrishna et al., 2006; Mutetwa and Mtaita, 2014).