temperatures that accelerate meristematic activity and shorten plastochron intervals, thereby increasing leaf production rates (Tarara, 2000; Lamont, 2005). Rice straw mulch was statistically comparable to plastic mulch at 90 and 120 DAT, suggesting its nutrient-release profile increasingly supports rapid leaf development as the crop approaches the grand growth phase. These trends mirror findings of Kabir et al. (2013), who reported plastic mulch superiority for early-stage leaf development with straw mulch increasingly competitive at later stages.

Table 2 Effect of mulching treatments on number of leaves per plant of onion (*Allium cepa* L.) at 30, 60, 90, and 120 days after transplanting (DAT)

Treatments	Number of leaves per plant			
	30 DAT	60 DAT	90 DAT	120 DAT
Control	4.13b	5.67c	7.13c	7.47b
Banana leaf mulch	4.27ab	6.00bc	7.87bc	7.93ab
Sawdust mulch	4.20b	6.13b	8.07b	8.20ab
Rice straw mulch	4.53ab	6.67ab	8.80ab	8.73a
Plastic mulch	4.73a	7.00a	9.27a	9.00a
LSD ($p \le 0.05$)	0.51	0.57**	0.75**	0.84**
CV (%)	6.32	5.14	5.51	6.87
Grand mean	4.37	6.29	8.23	8.27

Note: Means in a column followed by different lowercase letters differ significantly at $p \le 0.05$ (DMRT). ** $p \le 0.01$. DAT: days after transplanting; LSD: least significant difference; CV: coefficient of variation

3.3 Leaf length

Leaf length increased from transplanting through 90 DAT before declining at 120 DAT as assimilates were redirected to bulb storage organs (Table 3). Rice straw mulch consistently produced the longest leaves at all stages (25.88, 46.32, 58.14, and 42.37 cm at 30, 60, 90, and 120 DAT). Plastic mulch was statistically at par at all stages. The enhancement under rice straw mulch is attributed to improved nitrogen availability from mineralizing organic matter, which elevates leaf chlorophyll content and photosynthetic efficiency, sustaining leaf expansion (Baten et al., 1995; Nair and Ngouajio, 2012). The control consistently produced the shortest leaves, reflecting competitive water stress and nutrient immobilization associated with soil crusting in unmulched plots.

Table 3 Effect of mulching treatments on leaf length (cm) of onion (*Allium cepa* L.) at 30, 60, 90, and 120 days after transplanting (DAT)

Treatments	Leaf length (cm)			
	30 DAT	60 DAT	90 DAT	120 DAT
Control	22.53b	38.91c	46.07d	30.44d
Banana leaf mulch	23.94ab	41.72bc	49.53c	34.88c
Sawdust mulch	24.27ab	43.46ab	52.71bc	37.08bc
Rice straw mulch	25.88a	46.32a	58.14a	42.37a
Plastic mulch	25.17a	45.53a	55.92ab	41.14ab
LSD ($p \le 0.05$)	2.21*	3.14*	3.88***	4.31***
CV (%)	5.24	4.33	3.97	6.22
Grand mean	24.36	43.19	52.47	37.18

Note: Means in a column followed by different lowercase letters differ significantly at $p \leqslant 0.05$ (DMRT). * $p \leqslant 0.05$; *** $p \leqslant 0.001$. DAT: days after transplanting; LSD: least significant difference; CV: coefficient of variation

3.4 Yield and yield-associated parameters

All yield parameters except root length were significantly affected by mulching treatments (Table 4). The absence of a statistically significant mulch effect on root length ($p > 0.05$) likely reflects high intra-block variability and the sensitivity of onion root architecture to micro-scale irrigation uniformity (Larkin, 2020).