



Effects of mulching and sowing date on earliness, fruit quality and economics of round gourd (*Praecitrullus fistulosus*)

MANPREET SINGH¹, NAVEEN GARG^{2*}, MONIKA MAHAJAN¹ and KULBIR SINGH¹

Regional Research Station (Punjab Agricultural University, Ludhiana, Punjab), Bathinda, Punjab 151 001, India

Received: 18 May 2024; Accepted: 13 May 2026

Keywords: Economics, Quality, Mulch, Sowing time, Tinda

The immature fruits of round gourd [*Praecitrullus fistulosus* (Stocks) Pangalo] are good source of water, ascorbic acid, minerals (calcium, phosphorus, etc.) and dietary fibre (Singh and Garg 2024). Ascorbic acid acts as an antioxidant, reduces cell damage and helps in formation of collagen (a nutrient that makes skin structure) which improves skin elasticity and protects skin from ultra-violet rays (Thakur and Sharma 2018). Dry matter consists of all biochemical components other than water. Low dry matter indicates fruit tenderness and is desirable in vegetables which are consumed fresh (Scalisi and O'Connell 2021). Crude fibre refers to the residues, such as cellulose and lignin, which remain after fruits' digestion with acid and alkali. It determines fruits' consumer acceptability (Dhingra *et al.* 2012). The consumption of dietary fibre is linked to overall metabolic health, colon health and gut motility. Besides, it reduces the risk of cardiovascular diseases and colorectal cancer (Barber *et al.* 2020). Ash content refers to inorganic residue left-over after the complete oxidation of organic substance in fruit. High fruit ash content is desirable as they increase their nutritive value (Narayanan *et al.* 2017).

Fruit quality of bell pepper (Kaur *et al.* 2020), okra (Tanveer *et al.* 2022), muskmelon (Anusha *et al.* 2021) and winter squash (Conti *et al.* 2015) is influenced by mulching and sowing time. Although the effects of mulching on soil temperature, nutrient uptake, plant growth and yield components of round gourd have earlier been reported by Birbal *et al.* (2019), Singh and Garg (2024) and Singh *et al.* (2026), information is still lacking for earliness, fruit quality and economics. Therefore, present study was aimed to investigate the effects of sowing time, mulching and their interaction on earliness, fruit quality and economics of round gourd.

The field experiment was conducted during March to

September, 2021 and 2022 at Regional Research Station (Punjab Agricultural University, Ludhiana, Punjab), Bathinda (30°17'N, 74°58'E; at an elevation of 211 m amsl), Punjab. Experimental site has loamy sand soil along with semi-arid climate. Initial properties of the experimental soil (0–15 cm depth) were recorded: pH (8.4 and 8.5), electrical conductivity (0.206 and 0.230 dS/m), organic carbon (0.18% and 0.23%), available phosphorus (18.2 and 20.9 kg/ha) and available potassium (307.6 and 413.6 kg/ha) during first and second year, respectively. The variety selected for the study was 'Punjab Tinda 1'. The experiment was laid out in a split-plot design (SPD) replicated thrice. The main plot comprised of six sowing times i.e. first week of March (DS1), April (DS2), May (DS3), June (DS4), July (DS5) and August (DS6) while sub-plot comprised of three mulches [silver-black plastic (SBPM) (25 µm thick), black plastic (BPM) (25 µm thick) and paddy straw (PSM) (6 t/ha)] and bare soil (BS). Seeds were sown on both sides of the beds (2.0 m wide and 15 cm raised) at an intra-row spacing of 45 cm. Net plot size was 4.5 m × 2.0 m to accommodate 20 plants.

Ten fruits/plot were taken from peak harvest to estimate ascorbic acid (mg/100 g fresh weight), dry matter (%), fibre (% dry weight) and ash content (% dry weight) (AOAC 2005). For economic analysis, cost of produce was taken as ₹25/kg in DS1, ₹20 in DS2, ₹30 in DS3 and DS4 and ₹35/kg in DS5 and DS6. The cost of PSM (₹2,000/t) and plastic mulch (₹1,800/roll of 400 m × 1.2 m) was taken as per market rates. Produce marketing and transportation charges were taken as ₹0.50/kg. Benefit-cost ratio was calculated by dividing net returns (₹/ha) with total cost of cultivation (₹/ha). Data generated were analysed and presented as pooled over two years.

Earliness: Days to first picking is a beneficial economic trait as early yield fetches higher market price. Irrespective of sowing time, the SBPM, BPM and PSM reduced the days taken to first harvest by 11.9%, 8.4% and 4.7%, respectively, over BS (Table 1), which might be due to modification in soil hydro-thermal regimes. In round gourd, Birbal *et al.* (2019) have also reported 12.5% and 11.5% reduction in days taken

¹Punjab Agricultural University, Ludhiana, Punjab; ²Regional Research Station (Punjab Agricultural University, Ludhiana, Punjab), Bathinda, Punjab. *Corresponding author email: naveengargpau@gmail.com

Table 1 Effects of date of sowing, mulching and their interaction on earliness and fruit quality of round gourd (pooled data of two years)

Treatment	Days to first picking	Ascorbic acid (mg/100 g fresh weight)	Dry matter (%)	Fibre (% dry weight)	Ash content (% dry weight)
Date of sowing (DS)					
DS1	44.7	15.4	5.79	2.28	6.61
DS2	47.0	17.6	6.28	2.24	7.47
DS3	41.7	17.8	5.61	2.16	6.59
DS4	47.3	17.5	6.06	2.09	6.72
DS5	44.4	16.2	6.09	2.28	6.55
DS6	40.0	16.6	5.44	2.18	6.83
CD (DS) ($p = 0.05$)	1.8	0.7	0.21	0.07	0.25
Mulching (M)					
SBPM	41.5	18.7	5.89	2.38	7.45
BPM	43.2	17.7	5.80	2.34	7.29
PSM	44.9	16.2	6.07	2.19	6.80
BS	47.1	14.8	5.74	1.95	5.64
CD (M) ($p = 0.05$)	0.6	0.4	0.13	0.07	0.16
Interaction					
DS1 + SBPM	41.0	17.3	5.62	2.47	7.21
DS1 + BPM	41.7	16.2	5.96	2.32	7.07
DS1 + PSM	46.7	14.5	5.84	2.34	6.63
DS1 + BS	49.3	13.5	5.75	2.01	5.52
DS2 + SBPM	44.3	19.8	6.30	2.42	7.80
DS2 + BPM	45.7	18.6	6.04	2.42	7.62
DS2 + PSM	48.5	17.1	6.24	2.11	7.42
DS2 + BS	49.3	14.8	6.32	2.02	7.03
DS3 + SBPM	39.2	18.6	5.56	2.35	7.39
DS3 + BPM	40.8	18.3	5.61	2.38	7.24
DS3 + PSM	42.3	17.6	5.78	2.12	6.56
DS3 + BS	44.3	16.7	5.50	1.82	5.17
DS4 + SBPM	43.2	19.2	6.12	2.20	7.48
DS4 + BPM	45.5	18.8	5.99	2.17	7.45
DS4 + PSM	48.8	16.9	6.35	1.99	6.68
DS4 + BS	51.8	15.0	5.80	2.02	5.27
DS5 + SBPM	42.3	18.7	6.19	2.51	7.15
DS5 + BPM	46.0	16.8	5.86	2.47	6.97
DS5 + PSM	43.5	15.1	6.47	2.29	6.68
DS5 + BS	45.7	14.1	5.82	1.97	5.43
DS6 + SBPM	38.8	18.3	5.57	2.31	7.66
DS6 + BPM	39.3	17.6	5.37	2.30	7.40
DS6 + PSM	39.7	16.0	5.52	2.29	6.86
DS6 + BS	42.2	14.4	5.28	1.85	5.42
CD (DS $\times$ M) ($p = 0.05$)	1.6	1.0	0.31	0.17	0.38

DS1, DS2, DS3, DS4, DS5 and DS6 refer to first week of March, April, May, June, July and August, respectively. SBPM, Silver-black plastic mulch; BPM, Black plastic mulch; PSM, Paddy straw mulch; BS, Bare soil.

to first flower with BPM and straw mulching, respectively, over BS. Irrespective of mulching, maximum days to first picking were recorded in DS4 and DS2, whereas the earliest harvest was recorded in DS6 and DS3 (Table 1). It might be due to the reason that at high temperatures, growth phases of cucurbits like days to flowering and days to fruit harvest are attained faster (Wehner and Guner 2004). Interaction effects revealed that the earliest harvest was recorded by DS6 + SBPM (Table 2). In sponge gourd, the BPM gave earliest flowering (38.7 days) compared to rice straw mulch (42.3 days) and BS (45.0 days) (Khan *et al.* 2015).

Ascorbic acid: Irrespective of sowing time, the SBPM, BPM and PSM increased the fruit ascorbic acid over BS by 26.4%, 19.6% and 9.5%, respectively (Table 1). This might be due to enhanced vegetative growth and photosynthesis with mulching leading to higher synthesis of sugars which

are the primary precursors of ascorbic acid. Kaur *et al.* (2020) have reported 6.9% increase in ascorbic acid of bell pepper fruits with PSM over BS. Irrespective of mulching, the highest ascorbic acid was recorded in DS3, DS2 and DS4 (Table 1). Muskmelon fruits harvested from mid-November planted crop had higher ascorbic acid compared with mid-January planted crop (Anusha *et al.* 2021). Interaction effects revealed that the maximum ascorbic acid was observed with DS2 + SBPM (Table 1).

Dry matter: Irrespective of sowing time, maximum fruit dry matter was registered with PSM, minimum in BS and BPM whereas the SBPM recorded intermediate values (Table 1). The PSM, SBPM and BPM increased fruit dry matter over BS by 5.7%, 2.6% and 1.0%, respectively. It might be due to higher nutrient uptake with mulching (Singh *et al.* 2026) which directly contribute to dry matter

Table 2 Effects of mulching on economics of round gourd variety 'Punjab Tinda 1' under variable sowing dates (pooled data of two years)

Treatment (Date of sowing + mulching)	Total cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	Benefit cost ratio
DS1 + SBPM	1,07,845	4,17,103	3,09,258	2.87
DS1 + BPM	1,06,817	3,65,682	2,58,865	2.42
DS1 + PSM	80,437	2,56,711	1,76,274	2.19
DS1 + BS	80,403	2,55,011	1,74,608	2.17
DS2 + SBPM	1,08,102	3,43,974	2,35,872	2.18
DS2 + BPM	1,07,094	3,03,631	1,96,538	1.84
DS2 + PSM	80,876	2,22,905	1,42,030	1.76
DS2 + BS	80,131	1,93,121	1,12,990	1.41
DS3 + SBPM	1,02,801	1,97,864	95,063	0.92
DS3 + BPM	1,02,264	1,65,669	63,405	0.62
DS3 + PSM	77,119	1,08,960	31,841	0.41
DS3 + BS	76,592	77,319	728	0.01
DS4 + SBPM	1,01,332	1,09,712	8,380	0.08
DS4 + BPM	1,01,103	95,990	-5,113	-0.05
DS4 + PSM	76,485	70,894	-5,591	-0.07
DS4 + BS	76,229	55,549	-20,680	-0.27
DS5 + SBPM	1,00,181	47,443	-52,738	-0.53
DS5 + BPM	99,788	19,950	-79,838	-0.80
DS5 + PSM	75,699	27,745	-47,954	-0.63
DS5 + BS	75,565	18,349	-57,216	-0.76
DS6 + SBPM	1,00,646	80,031	-20,615	-0.20
DS6 + BPM	1,00,617	77,960	-22,656	-0.23
DS6 + PSM	75,782	33,527	-42,255	-0.56
DS6 + BS	75,570	18,719	-56,852	-0.75

DS1, DS2, DS3, DS4, DS5 and DS6 refer to first week of March, April, May, June, July and August, respectively. SBPM, Silver-black plastic mulch; BPM, Black plastic mulch; PSM, Paddy straw mulch; BS, Bare soil.

accumulation in fruits. Kaur *et al.* (2020) have reported 6.3% increase in dry matter of bell pepper fruits with PSM over BS. Irrespective of mulching, highest fruit dry matter was observed in DS2 and DS5 (Table 1). Interaction effects revealed that the maximum dry matter was recorded with DS5 + PSM (Table 1).

Fibre: Irrespective of sowing time, the SBPM, BPM and PSM increased the fruit fibre over BS by 22.1%, 20.0% and 12.3%, respectively (Table 1). Irrespective of mulching, highest fruit fibre was recorded in DS1, DS5 and DS2, whereas the lowest was observed in DS4 and DS3 (Table 1). Interaction effects revealed that the maximum fruit fibre was recorded with DS5 + SBPM (Table 1).

Ash content: Irrespective of sowing time, the SBPM, BPM and PSM increased the fruit ash content by 31.6%, 28.1% and 19.3%, respectively over BS (Table 1), which might be due to enhanced nutrient availability and uptake with mulching (Singh *et al.* 2026). Utilisation of compost as mulch increased the ash content of okra fruits by 24% as compared with BS (Tanveer *et al.* 2022). Irrespective of mulching, maximum fruit ash content was recorded in DS2 whereas the minimum was recorded in DS5 which was at par with DS3, DS1 and DS4 (Table 1). Conti *et al.* (2015) also reported differences in ash content of winter squash fruits from the crop transplanted on 2nd April (5.8%), 16th April (5.9%), 30th April (6.2%) and 14th May (6.4%). Interaction effects revealed that the maximum ash content was observed with DS2 + SBPM (Table 1).

Economics: Total cost of cultivation was highest with plastic mulching under all sowing dates (Table 2) due to the cost of plastic film, although, it reduced weeding expenses. Total cost of cultivation with PSM was almost at par with BS under all sowing dates as the weeding expenses incurred in BS and saved using PSM were almost equal to the cost of PSM and its application. Maximum gross returns, net returns and BC ratio were observed with SBPM followed by BPM, PSM and BS under all sowing dates except DS5 wherein PSM proved better than BPM. Gross returns, net returns and BC ratio with SBPM and BPM were highest in DS1 but declined with each successive sowing date. Gross returns, net returns and BC ratio with PSM were marginally superior to that with BS in DS1. But this difference exhibited an increasing trend with each successive sowing date i.e. DS2 onwards, which manifested the soil-cooling advantage of PSM under late-planting conditions. Net returns were positive for all mulch types and BS in DS1 to DS3 and with SBPM in DS4 but were negative in other cases (Table 2) due to crop/cultivar sensitivity to heavy rainfall or high relative humidity in monsoon season. Therefore, mulching technology was beneficial in DS1 to DS4. In DS5 and DS6, benefit accrued using plastic mulching could not overcome its cost.

SUMMARY

A two-year study conducted on round gourd in Punjab revealed that irrespective of sowing time, the lowest days to first picking and the highest fruit quality attributes

(ascorbic acid, fibre and ash content) were recorded by SBPM followed by BPM and PSM. However, the highest fruit dry matter was recorded by PSM followed by SBPM. Irrespective of mulching, the highest ascorbic acid, dry matter, fibre and ash content was manifested in DS2. The interaction effects revealed that the maximum ascorbic acid and ash content were observed in DS2 + SBPM while dry matter and fibre were maximum in DS5 + PSM and DS5 + SBPM, respectively. The maximum gross returns, net returns and BC ratio were observed with SBPM followed by BPM, PSM and BS. However, based on BC ratio, it is recommended to use SBPM or BPM in DS1; SBPM, BPM or PSM in DS2 and DS3; whereas, only SBPM should be used in DS4 for cultivation of round gourd 'Punjab Tinda 1' in Punjab.

REFERENCES

- Anusha K R, Singh K, Sardana V, Sharma S P and Singh R. 2021. Influence of planting time and mulching on yield and quality of direct sown muskmelon (*Cucumis melo* L.) under low tunnel. *Vegetable Science* **48**(2): 150–55.
- AOAC. 2005. *Official Methods of Analysis*, 18th edn. Association of Official Analytical Chemists International, Gathersburg.
- Barber T M, Kabisch S, Pfeiffer A F H and Weickert M O. 2020. The health benefits of dietary fibre. *Nutrients* **12**(10): 3209. <https://doi.org/10.3390/nu12103209>
- Birbal, Soni M, Rathore V S, Nathawat N S and Renjith P S. 2019. Interactive effect of FYM and mulching on productivity and water use efficiency of squash melon (*Citrullus vulgaris* var. *fistulosus*) grown with supplemental irrigation in hot arid region of Rajasthan. *The Indian Journal of Agricultural Sciences* **89**(2): 307–13.
- Conti S, Villari G, Amico E and Caruso G. 2015. Effects of production system and transplanting time on yield, quality and antioxidant content of organic winter squash (*Cucurbita moschata* Duch.). *Scientia Horticulturae* **183**: 136–43.
- Dhingra D, Michael M, Rajput H and Patil R T. 2012. Dietary fibre in foods: A review. *Journal of Food Science and Technology* **49**(3): 255–66.
- Kaur A, Sekhon K S, Thaman S, Sidhu A S, Garg N and Chawla N. 2020. Effect of paddy straw mulch, irrigation regimes and nitrogen levels on the performance of spring transplanted bell pepper in semi-arid environment of south-western Punjab. *Vegetable Science* **47**(1): 74–79.
- Khan S, Pal M and Kumar V. 2015. Influence of different mulches on growth and yield sponge gourd (*Luffa cylindrica* L.). *Plant Archives* **15**(1): 393–95.
- Narayanan A, Keerthana G and Ravikumar V. 2017. Mineral and anti-nutrient content of common and uncommon green leafy vegetables before and after drying. *Food Science* **108**: 47403–07.
- Scalisi A and O'Connell M G. 2021. Relationships between soluble solids and dry matter in the flesh of stone fruit at harvest. *Analytica* **2**: 14–24.
- Singh M and Garg N. 2024. Effects of mulching on plant growth, viral diseases, earliness and fruit yield attributes of round gourd under variable sowing dates in north Indian plains. *The Journal of Agricultural Science* **162**: 225–35.
- Singh M, Garg N, Yadav B K, Singh P and Choudhary O P. 2026. Relationship of round gourd (*Praecitrullus fistulosus*) fruit yield with soil temperature and nutrient uptake under different

- mulches and sowing times. *Journal of Crop Improvement* **40**(1): 50–70.
- Tanveer A, Sarwar M, Asghar M S, Saleem M F, Maqsood H, Ali B, Munir M K, Arshad M, Ikram R M, Ikram N A and Rizwan M. 2022. Reducing nutrient uptake in okra weeds by suppressing their population through alligator weed compost mulch for better pod yield and quality. *Arabian Journal of Geosciences* **15**(10): 1006. <https://doi.org/10.1007/s12517-022-10300-5>
- Thakur A and Sharma R. 2018. Vitamin C enriched bitter gourd based functional squash. *The Pharma Innovation Journal* **7**(3): 98–103.
- Wehner T C and Guner N. 2004. Growth stage, flowering pattern, yield and harvest date prediction of four types of cucumber tested at 10 planting dates. *Acta Horticulturae* **637**: 223–29.