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# PERFORMANCE OF DIFFERENT MULCHING MATERIALS WITH FERTILIZER LEVELS ON MORPHOLOGICAL GROWTH AND YIELD OF POTATO IN THE CENTRAL PLAINS OF INDIA

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**ABSTRACT: Mulching is essential for sustainable horticulture practices in this region as it helps reduce soil moisture loss, regulate soil temperature and minimize erosion. Examining different types of mulch in this specific climate can aid in developing adaptive strategies to mitigate the adverse effects of climate variability and enhance horticultural resilience. In the experiment, two factors were considered: five types of mulching materials—maize straw, polythene (25 microns), woven mulch, and silver mulch—and two fertilizer levels—75 % and 100 % of the RDF (120:100:100 NPK kg/ha). The experiment was conducted under the All India Coordinated Research Project on Potato at JNKVV, Chhindwara. Results revealed that all mulched treatments significantly outperformed the control (without mulch). The highest yield was recorded with polythene sheet mulch (31.73 t/ha), followed by maize straw mulch (30.13 t/ha). Maize straw mulch provided an additional yield of 10.24 t/ha over the control. Among fertilizer levels, 100% RDF (120:100:100 kg/ha NPK) produced the highest yield (31.73 t/ha). The combined effect of mulch and fertilizer showed that the highest yield (30.93 t/ha) was obtained in the F2M2 treatment (100% RDF with polythene mulch), whereas the lowest yield (18.73 t/ha) was recorded in the F1M0 treatment (75% RDF without mulch). These results highlight the importance of mulching and optimized fertilization in enhancing potato yield in the central plains of India.**

**KEYWORDS:** Fertilizer, morphological growth, mulches, potato

## INTRODUCTION

Potato (*Solanum tuberosum* L.) is the third most important food crop globally after rice and wheat in terms of human consumption. It originated in the Peruvian-Bolivian Andes Mountains of South America and belongs to the Solanaceae family. Currently, potatoes are cultivated in more than 160 countries and are recognized as one of the four major agronomic crops (Donnelly and Kubow, 2011). Potatoes are vegetatively propagated, with each plant capable of producing 5–20 new tubers that are genetic clones of the mother plant. Potatoes are highly efficient food crops, producing substantial dry matter, edible protein, and essential minerals. They are rich in vital nutrients, including vitamins C and B6, as well as minerals such as potassium, magnesium, and iron. Additionally, they contain B vitamins like riboflavin, thiamine, and folate, making them a valuable dietary source of vitamin B6. Due to their short growing cycle and flexibility in planting and harvesting, potatoes integrate well into multiple cropping systems and hold significant commercial value (Choudhary (2021).

Conventional potato production methods face several challenges. While fertilization and irrigation are commonly used to enhance yield, other crucial factors often receive less attention. Soil moisture fluctuations have

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been reported to adversely impact seed germination, crop emergence, and overall production (Ahmed *et al*., 2017). Balancing productivity, profitability and environmental health is a key challenge for agricultural sustainability (Singh *et al.*, 2021). Potato cultivation requires a moderate temperature range for optimal growth. Extreme heat or cold can significantly reduce yield, with the ideal temperature for potato production being between 15–20°C. Growth declines when temperatures drop below 15°C or exceed 20°C (Gautam *et al*., 2025). Additionally, weed infestation poses a major challenge, as weeds compete with potato plants for nutrients, water, and sunlight, ultimately reducing yield (Ferdous *et al*., 2017).

Mulching is an effective agronomic practice that modifies the plant micro-environment to enhance crop yield. Based on the type of materials used, mulching can be broadly categorized into three types: organic mulching (e.g., crop straw, leaves, geotextiles), inorganic mulching (e.g., plastic films, biodegradable films), and mixed mulching (e.g., combinations of plastic, straw, grass, and gravel) (Kader *et al*., 2017). Mulching practices have both direct and indirect benefits on microclimatic conditions and crop productivity. It effectively prevents soil erosion and reduces water loss from arable lands (Prosdocimi *et al*., 2016). Soil characteristics and climatic conditions might have influenced growth in addition to mulches (Karangwa *et al*., 2023). Additionally, mulching minimizes nitrogen leaching, enhances nutrient availability and improves overall soil quality (Haraguchi *et al*., 2004). Plastic mulching significantly influences soil hydrothermal conditions by increasing soil temperature and reducing moisture loss through evaporation (Wang *et al*., 2005). Among the various mulching techniques, plastic and straw mulching are widely adopted in potato cultivation. Straw mulching, in particular, is a practical and sustainable approach in regions where straw is readily available (Tang *et al*., 2015). It plays a crucial role in reducing soil evaporation and erosion, improving soil moisture retention, regulating temperature, increasing soil enzymatic activity, and suppressing weed growth (Akhtar *et al*., 2018). Furthermore, straw mulching enhances soil nutrient availability, boosts crop productivity, and mitigates environmental pollution caused by straw burning, contributing to both agronomic and ecological sustainability (Pengfei Li *et al*., 2025). The Central Plains of India, including Madhya Pradesh, experience a combination of semi-arid and sub-humid climatic conditions, making soil moisture conservation a critical factor for sustainable agriculture.

Straw mulch is particularly beneficial in regions where organic residues are readily available. In the Central Plains of India, especially in Madhya Pradesh, maize straw is abundantly produced, making it a cost-effective and sustainable mulching option. Utilizing maize straw as mulch can significantly reduce production costs while improving soil moisture retention, suppressing weeds, and enhancing soil fertility. Despite the well-documented benefits of mulching, limited studies have evaluated its effectiveness in the Central Plains of India. This study investigates the impact of different mulching materials in combination with varying fertilizer levels on the morphological growth and yield of potatoes in this region. Unlike previous research, this study provides a comprehensive evaluation of the agronomic and economic viability of different mulch types, particularly emphasizing maize straw as a locally available and sustainable alternative. The findings will help optimize mulching practices for improved potato productivity in the central plains of India.

## MATERIAL AND METHOD

### Experimental site

The experiment was conducted during the 2020-21 and 2021-22 cropping seasons under the All India Coordinated Research Project on Potato at JNKVV, Chhindwara, Madhya Pradesh, India. The experimental site is situated at 22°3′26.77″ N latitude and 78°56′17.42″ E longitude, at an altitude of 675 meters above mean sea level. The region has a semi-arid to sub-tropical climate, with an average annual rainfall of 1350 mm. The soil of the experimental site was sandy loam in texture with a neutral pH of 7.33. It was rich in organic carbon (1.52%) and contains available nitrogen (332 kg/ha), phosphorus (35 kg/ha), and potassium (157 kg/ha).

To ensure relevance, the study incorporates average seasonal data on rainfall, relative humidity, and temperature during the potato-growing period for both years. Total rainfall received during the crop growth period was 1.23 mm. The average maximum and minimum temperatures during the season were 29.9°C and 11.4°C, respectively. Relative humidity ranged from 23.5% to 80.7%, influencing crop growth and development. These climatic conditions played a crucial role in influencing potato growth and yield during the study period.

### Experimental Design and Treatments-

The gross plot size measured 4.8 m x 4.0 m, while the net plot size was 3.6 m x 3.6 m. The experiment was laid out in a Split-Plot Design with three replications. The study involved two factors: five different mulching materials and two fertilizer levels, leading to 10 treatment combinations. The treatments were as follows: - Mulching Materials: - M0: No mulch (control), M1: Maize straw mulch, M2: Polythene mulch (25 microns), M3: Woven mulch, M4: Silver mulch, Fertilizer Levels are as F1: 75% of Recommended Dose of Fertilizers (RDF) (90:75:75 kg NPK/ha), F2: 100% of RDF (120:100:100 kg NPK/ha). Woven mulches are landscaping fabrics typically made from woven or knitted polypropylene, as well as blends of cotton, jute, coir, and polyester. They are characterized by a medium texture and thickness, high tear resistance, good elongation, and lightweight properties. The potato variety *Kufri Chipsona-3* was used for the experiment. The crop was planted at a spacing of 60 × 20 cm (row to row and plant to plant) in the first week of November each year. The nitrogen was applied in three split doses—basal, 30 days after planting (DAP), and 45 DAP—as per the treatment requirements. Haulms were cut at 100 DAP, and harvesting was done 15 days after haulm cutting.

### Mulch Application and Irrigation Details

Mulches were applied immediately after planting. Organic mulch (maize straw) was applied at a rate of 5 t/ha, while synthetic mulches were laid over the ridges. Ridge and furrow irrigation method was used at the intervals of 8 to 10 days to maintain optimal soil moisture levels based on crop water requirements and prevailing weather conditions. Agronomic practices and fertilizer application followed the recommended guidelines for the region, with reference to standard soil fertility recommendations.

### Observations Recorded

The following parameters were recorded to assess the impact of treatments: Growth parameters: Emergence percentage (30 DAP), plant height (50 DAP), number of shoots per plant (50 DAP), and number of compound leaves per plant (50 DAP). Yield parameters**:** Grade-wise tuber yield, total tuber yield (t/ha), total tuber number (000′/ha). Quality parameters: Dry matter content of tubers and haulms (%). Economic analysis: Gross and net returns, benefit-cost (B:C) ratio for different treatments.

### Statistical data analysis

The data were subjected to analysis of variance (ANOVA) appropriate to the Split Plot Design using OPSTAT software. Treatment means were compared using the Least Significant Difference (LSD) test at a 5% level of significance ($P < 0.05$) to determine significant differences among treatments.

## RESULT AND DISCUSSION

The average of two-year data, results of the present investigation show that different growth and yield parameter such emergence percentage, plant height and number of shoots, leaves, grade wise total yield, grade wise tuber at harvesting and economics were influenced by different mulches and fertilizer's levels.

### Effect of different mulches on plant growth & yield parameters

The percentage of plant emergence ranged from 93.50% to 94.63%, while plant height varied between 44.13 cm and 46.41 cm. The data are presented in Table 1, 2 and 3. The pictorial view of differents mulches are given in Fig. 1, 2, 3 and 4. The highest emergence percentage (94.63%) and maximum plant height (46.41 cm) were recorded with polythene mulch (M2), which was statistically comparable to all other treatments. In contrast, the lowest values for both parameters were observed in the control group. Among the treatments, the highest number of shoots per plant (7 shoots per plant) was observed with woven mulch, whereas the control and straw mulch treatments recorded the lowest shoot count (5.38 shoots per plant). Compared to unmulched conditions, mulching significantly improved grade-wise and total tuber yield, as well as the total tuber count. The highest grade-wise tuber yields recorded under polythene mulch were: 0–25 g tubers at 2.22 t/ha, 25–50 g tubers at 9.56 t/ha, 50–75 g tubers at 7.55 t/ha, and tubers over 75 g at 9.14 t/ha, resulting in a total tuber yield of 30.93 t/ha. Both maize straw and polythene sheet mulches demonstrated the highest yields, producing 27.36 t/ha and 30.93 t/ha, respectively. Notably, maize straw mulch yielded an additional 6.67 t/ha compared to the no-mulch condition.

The total tuber count was significantly higher under mulched conditions than in unmulched plots, as mulching helps regulate soil temperature and maintain optimal environmental conditions, which aligns with the findings of Hochmuth (2018). Generally, the increased yield observed with plastic mulches is associated with lower weed incidence, reduced insect pest damage, and decreased soil water evaporation, as reported by Orzolek *et al*. (1993). Similar yield improvements due to mulching have also been documented by Bharati (2020).

### Effect of fertilizer on plant growth parameters

The study found that the maximum plant emergence percentage was 95.50%, with an average plant height of 47.10 cm and an average of 6.60 shoots per plant (Table 1, 2 and 3) when applying the full recommended dose of fertilizer, which is 120:100:100 kg of N:P:K per hectare. In terms of yield, the highest grade-wise tuber yields were recorded as follows: 2.24 t/ha for the 0-25 g grade, 8.64 t/ha for the 25-50 g grade, 8.09 t/ha for the 50-75 g grade, and 7.73 t/ha for the >75 g grade. The total tuber yield reached 26.69 t/ha with the application of 100% of the recommended dose of N:P:K. This dosage also resulted in the highest number of tubers per hectare.

**Table 1. Effect of Mulches and fertilizer levels on emergence%, plant ht. (cm) & number of shoots/plant.**

| Treatment | Emergence % | | | | | | Plant height (cm) | | | | | | Number of shoots/plant | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A |
| F1 | 91.75 | 92.75 | 92.50 | 93.00 | 92.00 | 92.40 | 42.95 | 43.95 | 42.73 | 44.63 | 43.98 | 43.65 | 4.75 | 4.50 | 6.75 | 5.75 | 6.75 | 5.70 |
| F2 | 95.25 | 96.50 | 95.50 | 95.50 | 94.75 | 95.50 | 45.30 | 47.33 | 47.78 | 48.20 | 46.90 | 47.10 | 6.00 | 6.25 | 6.50 | 7.00 | 7.25 | 6.60 |
| Mean B | 93.50 | 94.63 | 94.00 | 94.25 | 93.38 | | 44.13 | 45.64 | 45.25 | 46.41 | 45.44 | | 5.38 | 5.38 | 6.63 | 6.38 | 7.00 | |
| LSD (5%) | | | | | | | | | | | | | | | | | | |
| F | | | | 1.03 | | | | | | 0.99 | | | | | | NS | | |
| **M** | | | | NS | | | | | | NS | | | | | | 1.04 | | |
| Mulch at same level of A | | | | NS | | | | | | NS | | | | | | NS | | |
| Fertilizer at same level of B | | | | NS | | | | | | NS | | | | | | NS | | |

**Table 2. Effect of Mulches and fertilizer levels on Grade wise yield.**

| Treatment | Yield of tuber 0-25 g (t/ha) | | | | | | Yield of tuber 25-50 g (t/ha) | | | | | | Yield of tuber 50-75 g (t/ha) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A |
| F1 | 1.07 | 1.53 | 1.87 | 1.28 | 1.58 | 1.46 | 5.34 | 8.91 | 9.90 | 5.40 | 7.44 | 7.40 | 4.78 | 7.32 | 8.38 | 6.97 | 9.13 | 7.31 |
| F2 | 1.42 | 2.70 | 2.57 | 1.99 | 2.51 | 2.24 | 7.91 | 9.33 | 9.21 | 9.65 | 7.09 | 8.64 | 7.88 | 7.77 | 9.91 | 6.50 | 8.37 | 8.09 |
| Mean B | 1.24 | 2.11 | 2.22 | 1.64 | 2.05 | | 6.62 | 9.12 | 9.56 | 7.53 | 7.26 | | 6.33 | 7.55 | 9.14 | 6.73 | 8.75 | |
| LSD (5%) | | | | | | | | | | | | | | | | | | |
| F | | | | 0.26 | | | | | | 0.95 | | | | | | NS | | |
| M | | | | 0.30 | | | | | | 0.63 | | | | | | 1.56 | | |
| Mulch at same level of A | | | | NS | | | | | | 1.08 | | | | | | NS | | |
| Fertilizer at same level of B | | | | NS | | | | | | 1.21 | | | | | | NS | | |

**Table 3. Effect of Mulches and fertilizer levels on Grade wise, total yield & total number of tubers.**

| Treatment | Yield of tuber > 75 g (t/ha) | | | | | | Total yield of tuber (t/ha) | | | | | | Total no. of tuber (000'/ha) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A |
| F1 | 7.54 | 6.93 | 9.98 | 7.64 | 5.02 | 7.42 | 18.73 | 24.68 | 30.13 | 21.29 | 23.16 | 23.60 | 231.79 | 331.00 | 435.79 | 342.00 | 313.82 | 330.88 |
| F2 | 5.45 | 10.24 | 10.05 | 5.59 | 7.33 | 7.73 | 22.65 | 30.04 | 31.73 | 23.73 | 25.30 | 26.69 | 324.24 | 382.14 | 502.38 | 430.20 | 379.25 | 403.64 |
| Mean B | 6.49 | 8.58 | 10.01 | 6.62 | 6.17 | | 20.69 | 27.36 | 30.93 | 22.51 | 24.23 | | 278.02 | 356.57 | 469.09 | 386.10 | 346.53 | |
| LSD (5%) | | | | | | | | | | | | | | | | | | |
| F | | | NS | | | | 2.54 | | | | | | 5.32 | | | | | |
| M | | | 0.86 | | | | 1.90 | | | | | | 7.90 | | | | | |
| Mulch at same level of A | | | 1.27 | | | | NS | | | | | | 11.84 | | | | | |
| Fertilizer at same level of B | | | 1.18 | | | | NS | | | | | | 11.17 | | | | | |

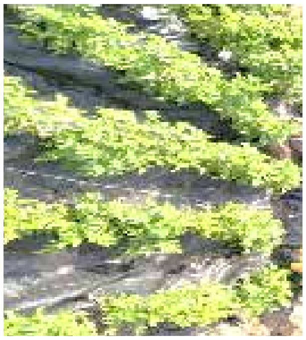

*Fig. 1. Polythene mulch*

*Fig. 2. Woven mulch*

*Fig. 3. Maize Straw mulch*

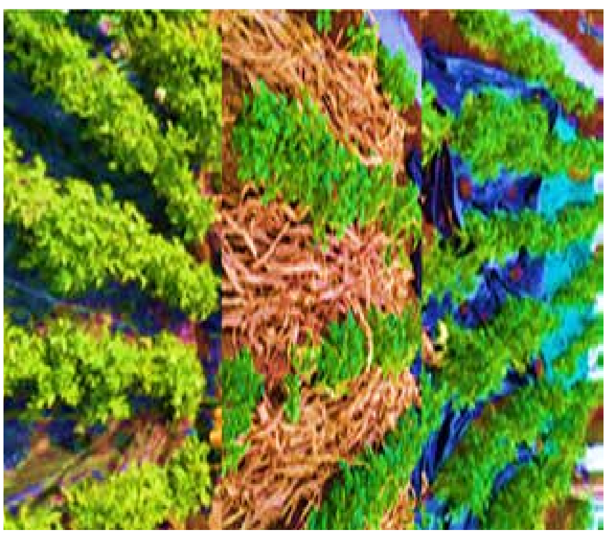

*Fig. 4. Combined view of different mulches*

Different levels of N:P:K fertilizers demonstrated varying effects on crop growth, yield attributes, and overall potato yield. However, the study by Choudhary *et al.*, (2021) noted that there were no significant differences in total tuber yield and benefit-cost ratio between the 150% dose (180:150:150 kg N:P:K per hectare) and the 100% dose (120:100:100 kg N:P:K per hectare). Similar findings were reported by Kumar *et al.* (2008). Additionally, Sinha (2007) concluded that the optimal application of nitrogen was 225 kg/ha to achieve higher tuberization efficiency and both marketable and total tuber yields and Sadawarti *et al.*, 2013) found higher tuber yield with Mulching over no mulching in all grades tubers of potato.

## Interaction

In the case of the combined effect of fertilizer and mulch, the maximum plant emergence of 96.50 percent was recorded with 100% RDF of N:P:K when using straw and polythene mulch. The maximum plant height was 48.20 cm, with an average of 7.00 shoots, and a tuber yield of 8.64 tons per hectare for the 25-50 gram grade, all achieved with 100% RDF of N:P:K combined with woven mulch. The highest yield of 31.73 tons per hectare was noted in treatment F2M2, which involved the application of 100% RDF with plastic mulch. Conversely, the lowest yield of 18.73 tons per hectare was recorded in treatment F1MO, which used 75% RDF without any mulch.

Nitrogen and phosphorus content, as well as nutrient uptake, were significantly higher in mulched plots compared to un mulched ones, which is essential for the proper vegetative growth of plants (Hundal *et al.,* 2000). Woven mulch is a fabric that promotes vegetative growth, while plastic mulch maintains optimum root temperatures for plant growth, resulting in improved nitrogen utilization efficiency and greater tuber yield. Additionally, the residue from straw contributes to the organic matter content of the soil and enhances its physico-chemical properties (Mahmood *et al.,* 2002).

## Dry matter content of tubers (%)

The dry matter content of tubers per 100 g of fresh weight was assessed under different

**Table 4. Effect of Mulches and fertilizer levels on Dry matter content of tuber (%) & haulm (%).**

| Treatment | Dry matter content of tubers (%) | | | | | | Dry matter content of haulm (%) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M0 | M1 | M2 | M3 | M4 | Mean A | M0 | M1 | M2 | M3 | M4 | Mean A |
| F1 | 18.45 | 18.78 | 19.38 | 18.90 | 18.70 | 18.84 | 7.63 | 8.34 | 9.37 | 9.41 | 9.23 | 8.80 |
| F2 | 19.55 | 19.80 | 19.83 | 19.88 | 19.53 | 19.72 | 9.13 | 9.82 | 9.61 | 9.40 | 9.41 | 9.47 |
| Mean B | 19.00 | 19.29 | 19.60 | 19.39 | 19.11 | | 8.38 | 9.08 | 9.49 | 9.40 | 9.32 | |
| LSD (5%) | | | | | | | | | | | | |
| F | | | | 0.24 | | | | | | 0.14 | | |
| M | | | | 0.32 | | | | | | 0.17 | | |
| Mulch at same level of A | | | | NS | | | | | | 0.26 | | |
| Fertilizer at same level of B | | | | NS | | | | | | 0.25 | | |

treatments and the interaction effects are presented in Table 4. The highest dry matter content was recorded at the 100% fertility level, with values of 19.72% for tubers and 9.47% for haulms. In contrast, the lowest dry matter content was observed at the 75% fertility level, measuring 18.74% for tubers and 8.80% for haulms. Among the mulching treatments, the white polythene mulch resulted in the highest dry matter content, with 19.60% for tubers and 9.49% for haulms. Conversely, the lowest dry matter content was recorded in the no-mulch treatment, with values of 19.00% for tubers and 8.38% for haulms. Although the interaction between fertility levels and mulching treatments was not statistically significant, the highest dry matter content was observed in the 100% N, P, K + white polythene mulch treatment, achieving 19.88% for tubers and 9.61% for haulms. In contrast, the lowest dry matter content was recorded under the 75% N, P, K + no mulch treatment, with 18.45% for tubers and 7.63% for haulms. These findings align with Nizam et al. (2017), who reported that mulching significantly increases dry matter content compared to unmulched conditions.

## Economic analysis

The economic evaluation of different fertilizer levels and mulching treatments revealed (Table 5) that F2M1 (100% RDF +

**Table 5. Economics affected by different treatments.**

| Treat. | Yield (t/ha) | Cost of cultivation (Rs/ha) | | | Cost (Rs/ha) | | Sale price (Rs/t) | Net returns (Rs/ha) | B:C Ratio |
|---|---|---|---|---|---|---|---|---|---|
| | | Seed | Fertilizer | Cultivation | Inputs | Produce | | | |
| $T_1$ | 18.73 | 45000 | 7095 | 45000 | 97095 | 187300 | 10000 | 90205 | 0.93 |
| $T_2$ | 24.68 | 45000 | 7095 | 53000 | 105095 | 246800 | 10000 | 141705 | 1.35 |
| $T_3$ | 30.13 | 45000 | 7095 | 75000 | 127095 | 301300 | 10000 | 174205 | 1.37 |
| $T_4$ | 21.29 | 45000 | 7095 | 70000 | 122095 | 212900 | 10000 | 90805 | 0.74 |
| $T_5$ | 23.16 | 45000 | 7095 | 65000 | 117095 | 231600 | 10000 | 114505 | 0.98 |
| $T_6$ | 22.65 | 45000 | 9210 | 45000 | 99210 | 226500 | 10000 | 127290 | 1.28 |
| $T_7$ | 30.04 | 45000 | 9210 | 53000 | 107210 | 300400 | 10000 | 193190 | 1.80 |
| $T_8$ | 31.73 | 45000 | 9210 | 75000 | 129210 | 317300 | 10000 | 188090 | 1.46 |
| $T_9$ | 23.73 | 45000 | 9210 | 70000 | 124210 | 237300 | 10000 | 113090 | 0.91 |
| $T_{10}$ | 25.30 | 45000 | 9210 | 65000 | 119210 | 253000 | 10000 | 133790 | 1.12 |

Maize Straw Mulch) achieved the highest net return of Rs1,93,190 per hectare with a benefit-cost (BC) ratio of 1.80. In comparison, the same fertility level (100% RDF) without mulch resulted in a net return of ₹1,27,290 per hectare with a BC ratio of 1.28, yielding 22.65 t/ha.

Furthermore, the application of maize straw mulch led to an additional yield of 7.38 t/ha compared to the non-mulched condition, highlighting its economic advantage in improving crop productivity and profitability. Maize straw mulch increased profitability by reducing input costs and improving yield, making it a sustainable alternative for farmers. Similar economic benefits of mulching in potato cultivation were reported by Bharati (2020).

## CONCLUSION

The study demonstrated that 100% RDF (120:100:100 NPK kg/ha) significantly improved potato growth and yield. Among mulching treatments, polythene mulch recorded the highest yield, while maize straw mulch provided the best economic returns. The combined application of 100% RDF with polythene or maize straw mulch proved to be the most effective strategy for maximizing potato productivity in the central plains of India. These findings highlight the importance of integrating optimal mulching techniques with balanced fertilization to achieve higher yields, improved quality, and greater economic returns in potato production.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## ETHICAL STATEMENT

This article does not contain any studies with human participants or animals performed by any of the authors.

## LITERATURE CITED


Akhtar Kashif, Wang Weiyu, Ren Guangxin, Khan Ahmad, Feng Yongzhong and Yang Gaihe (2018) Changes in soil enzymes, soil properties, and maize crop productivity under wheat straw mulching in Guanzhong, China. *Soil & Tillage Research*, **182**: 94–102.

Bharati S (2020) Effect of different mulching on yield and yield attributes of potato in Dadeldhura District, Nepal. *Malaysian Journal of Sustainable Agriculture*, **4**(2): 54-58.

Chen ZC and Liao H (2016) Organic acid anions: An effective defensive weapon for plants against aluminum toxicity and phosphorus deficiency in acidic soils. *Journal of Genetics and Genomic Research*, **43**: 631–638.

Choudhary B, Bakode S, Sharma S and Sharma SK (2021) Nutrient management of potato (*Solanum tuberosum* L.) under Satpura Zone of Madhya Pradesh by using SSNM Technique. *Frontiers in Crop Improvement*, **9** (Special Issue-IX): 3902-3906.

Choudhary (2021) Potential and Status of Potato Production in Madhya Pradesh. *GRISAAS–An Edited Book (1)*: 83-89.

Donnelly DJ, and Kubow S (2011) "Potato (Solanum tuberosum L.)." *Vegetables I: Asteraceae, Brassicaceae, Chenopodiaceae, and Cucurbitaceae*, edited by L. A. Henry, Springer, 2011, pp. 91-112.

Gautam S, Scheuring DC, Koym JW and Vales MI (2024) Assessing heat tolerance in potatoes: Responses to stressful Texas field locations and controlled contrasting greenhouse conditions. Front. Plant Sci. 15:1364244. doi: 10.3389/fpls.2024.1364244.

Haraguchi T, Marui A, Yuge K, Nakano Y and Mor K (2004) Effect of plastic-film mulching on leaching of nitrate nitrogen in an upland field converted from paddy. *Paddy Water Environment*, 2: 67–72

Hochmuth GH (2018) Polyethylene mulching for early vegetable production in North Florida *University of Florida IFAS Extension* **HS719** 1–6

Hundal IS, Sandhu KS, Daljeet S and Sandha MS (2000). Effects of different types of mulching and herbicidal treatments on nutrient uptake in tomato (*Lycopersicon esculentum*). *Haryana Journal of Horticultural Sciences*, **29**(3-4): 242-244.

Kader MA, Senge M and Mojid MA (2017). Effects of plastic-hole mulching on effective rainfall and readily available soil moisture under soybean (*Glycine max*) cultivation. *Paddy and Water Environment*. doi:10.1007/s10333-017-0585-z.

Karangwa A, Ndungutse V, Fashaho A, Habimana S, Manirere JD, Nsengimana V, Mulinga N, Imanishimwe C, Nshimirimana P, Rwubatse B and Nyagatare G (2023) Performance of different mulches on physical growth and yield of potato (*Solanum tuberosum* L.) in western Rwanda. *Potato Journal*, **50**(2): 123-131.

Kumar P, Trehan SP, Singh BP, Rawal S and Khan MA (2008) Precision nitrogen requirement of table potato (*Solanum tuberosum* L.) cultivars for different growth periods. *Indian Journal of Potato Association*, **28**(1): 60-61.

Mahmood M, Farooq K, Amjad H, Khan R (2002) Effect of mulching on growth and yield of potato crop. *Asian Journal of Plant Sciences*, **2**(10): 132-133.

Nizam UA, Nashir, UM, Afzal Hossain, Asad UZ, Zaman S and Chandra Halder (2017). Performance of mulching on the yield and quality of potato. *International Journal of Natural and Social Sciences*, **4**(2): 07-13.

Orzolek MD, Murphy J and Ciardi J (1993) The effect of coloured polyethylene mulch on the yield of squash, tomato, and cauliflower. *Final Report to the Pennsylvania Vegetable Marketing and Research Commodity Board*, The Pennsylvania State University, USA, 1:1-15.

Pengfei Li, Afeng Zhang, Helei Liu, Xinyu Zhu, Hangyu Xiao, Zihan Shan, Qaiser Hussain, Xudong Wang, Jianbin Zhou and Zhujun Chen (2025). Managing trade-offs among yield, carbon, and nitrogen footprints of wheat-maize cropping system under straw mulching and N fertilizer application in China's Loess Plateau. *Field Crops Research*, **325**:109821

Prosdocimi M, Tarolli P and Cerda A (2016) Mulching practices for reducing soil water erosion: a review. *Earth-Science Review*, **161**: 191-203.

Sadawarti MJ, Singh SP, Kumar Vinod, and Lal SS (2013) Effect of mulching and irrigation scheduling on potato cultivar Kufri Chipsona-1 in central India. *Potato Journal*, **40**(1): 65-71.

Singh SP, Sharma SK, Sadawarti MJ, Dua VK, Rawal S, and Kumar M (2021). Effect Of Crop Rotations, Weed Control Methods and Type of Sowing/ Planting Bed on Production, Economics and Nutrient Removal in Potato Based Cropping Systems. *Potato Journal*, **47** (2).

Sinha (2007) *Influence of nitrogen levels on growth and tuber yield in potato (Solanum tuberosum L.)*. Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, India, M.Sc. thesis:129p.

Tang H, Xiao X, Tang W, Wang K, Sun J, Li W and Yang G (2015) Effects of winter covering crop residue incorporation on CH4 and N2O emission from double-cropped paddy fields in southern China. *Environmental Science Pollution Research*, **22**: 12689-12698.

Wang XL (2005) Increasing potato yields with additional water and increased soil temperature. *Agricultural Water Management*, **78**: 181-194.

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