

Impact of Mulching in Potato Cultivation

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Introduction:

Potato is the fourth major food crop after rice, wheat, and maize in the world. It produces high dry matter, balanced protein, and high calories/ unit area / unit time. Potato tubers contain vitamin-C (17 mg/100 g) and vitamin-B. It provides carbohydrates, minerals, and fiber. The protein is as comparable to that of milk and egg. The crop is of short duration and fits well in intensive cropping system. Potatoes are used for several industrial purposes such as for the production of starch and alcohol. Potato starch (farina) is used in laundries and for sizing yarn in textile mills. Potatoes are also used for the production of dextrin and glucose. As a food product itself, potatoes are converted into dried products such as 'potato chips', 'sliced' or 'shredded potatoes'.

Mulching is a crucial practice in sustainable farming, helping to preserve soil fertility and prevent erosion. This approach is particularly important given the limitations of relying solely on fertilizers and irrigation. Effective water management is also essential,

as excessive irrigation can decrease crop yields and increase production costs. To address these challenges, adopting water-saving technologies is vital for boosting agricultural productivity, especially in areas with limited water resources. Potato cultivation relies heavily on effective soil and water management to ensure sustainable production. Mulching with crop residues optimizes soil temperature and moisture, leading to increased yields, reduced irrigation needs, and more efficient nitrogen use. Studies show that mulched soils have significantly higher microbial populations, while soil pH and electrical conductivity remain unaffected. In the plains, potatoes are typically planted in early October with recommended phosphorus and potassium applications, and harvested by late January. Tuber yields varied by soil type, with sandy loam outperforming loamy sand due to its higher water-holding capacity and inherent fertility. Mulching significantly boosted yields, increasing them by 22% in sandy loam and 31% in loamy sand. Irrigation benefits were more pronounced in sandy loam

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(20%) than loamy sand (14%). Mulching and irrigation interactions revealed that mulching's yield benefits were greater with less frequent irrigation. Notably, mulching saved 90-100 mm of irrigation water for a given yield.

Types of Mulches

There are two main categories of mulch: organic or inorganic mulches. The key difference is that organic mulch decomposes over time and turns into soil. Inorganic mulch does not decompose, though it may slowly break down into smaller pieces over time.

1. Organic Mulch

These mulches decompose over time, enriching the soil with nutrients. Common types include:

⇒ Wood-based:

- ☞ Wood chips: Versatile and widely available.
- ☞ Bark chips: Offer a decorative look.
- ☞ Pine straw: Ideal for acidic-loving plants.
- ☞ Sawdust: Best used in moderation.



⇒ Yard waste:

- ☞ Leaves: Shredded leaves provide excellent soil enrichment.
- ☞ Grass clippings: A readily available option, but use with caution.

⇒ Other organic materials:

- ☞ Straw: Great for vegetable gardens.
- ☞ Hay: Similar to straw, but may contain weed seeds.
- ☞ Compost: Adds valuable nutrients to the soil.
- ☞ Cocoa hulls: very decorative, but can be toxic to dogs.
- ☞ Cardboard/newspaper: useful for weed suppression.

2. Inorganic Mulches:

These mulches do not decompose and primarily serve to suppress weeds and retain moisture. Types include:

⇒ Stone-based:

- ☞ Gravel: Provides excellent drainage.
- ☞ Rocks: Offer a long-lasting, decorative option.
- ☞ Crushed stone.

⇒ Synthetic:

- ☞ Plastic sheeting: Effective for weed control, but can limit air and water flow.
- ☞ Landscape fabric: Allows water and air to pass through while blocking weeds.
- ☞ Rubber mulch: Made from recycled tires, durable but does not enrich soil.

Benefit of Mulching on Potato

Mulching had significant influence on potato growth and yield. Mulching improved seedling emergence, plant height and numbers of stems (Singh and Ahmed, 2008). On an average, mulching increased tuber yield by 25% over no mulch (Mahmood et al., 2002).

Improved soil fertility

Mulching has demonstrated efficacy to enhance soil health by reducing evaporation, increasing moisture retention, regulating temperature, enhancing nutrient availability and root absorption, encouraging biological activity, and controlling crop pests and diseases.

Moisture Retention: Mulch helps retain soil moisture, which is crucial for seed germination and seedling establishment. Consistent moisture prevents seeds from drying out, leading to better emergence rates.

Temperature Regulation:

Mulch acts as an insulator, moderating soil temperature. This is especially beneficial in areas with fluctuating temperatures. It can help keep the soil warmer in cooler periods and cooler in hot periods, creating a more stable environment for germination. Mulching can improve the emergence of seedlings and the height of the plants.

Reduced weed growth

Mulching can reduce the need for herbicides and the amount of weeds in the

field. Many weed seeds require light to germinate. By creating a barrier on the soil surface, mulch prevents sunlight from reaching these seeds, thus inhibiting their germination. This is a primary way that mulch suppresses weed growth.

Reduced exposure to disease

Mulching can reduce the amount of exposure potatoes have to soil-borne diseases. Many fungal and bacterial diseases spread through soil splash. When rain or irrigation water hits bare soil, it can carry pathogens up onto the lower leaves and stems of plants. Mulch acts as a physical barrier, preventing this splashing and reducing the spread of disease.

Improved water conservation

Mulching can help save water by improving soil humidity and reducing transpiration. The most significant way mulch conserves water is by creating a barrier that reduces the amount of water that evaporates from the soil surface. This is especially important during hot, dry weather.

Increased yields

Mulching can increase the number of tubers produced and the total tuber yield. Mulch insulates the soil, moderating temperature fluctuations. This is crucial for potatoes, as extreme temperatures can negatively impact tuber formation. Especially

in hot climates, mulch can keep the soil cooler, which is very beneficial for potato production.

Conclusion

Mulching significantly boosted yields, increasing them by 22% in sandy loam and 31% in loamy sand. Irrigation benefits were more pronounced in sandy loam (20%) than loamy sand (14%). Plant height, and number of stems is also improved with black polythene mulching. From the findings of the several studies shown that mulching with organic materials increase the soil nutrients the optimum soil temperature, restricts the rate of evaporation from the soil surface, restricts the weed growth and prevents the soil erosion. It also helps to improve the soil health.

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