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Effect of organic and inorganic mulch material on different varieties of potato (*Solanum tuberosum* L.) in foot hills of Uttarakhand

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Abstract

A field experiment was conducted to evaluate the effect of organic and inorganic mulch material on different varieties of potato (*Solanum tuberosum* L.) in foot hills of Uttarakhand. Four varieties (Gola, Kufri Badshah, Kufri Chandramukhi and Kufri Sindhuri) and three mulch levels (inorganic mulch, organic mulch and control) were analyzed in split plot design. Significantly higher plant height and number of shoots and economics was recorded under the variety V_2 (Kufri Badshah). Whereas in case of yield parameters, there is no significant difference was found. Mulch significantly affected the growth, yield and yield parameters as well as the economics. Interaction between varieties and mulch found significant with respect to plant height.

Keywords: *Solanum tuberosum*, varieties, potato, growth, mulch and economics

Introduction

Potato (*Solanum tuberosum* L.) is the third most important food crop in consumption in the world after rice and wheat (Hancock *et al*., 2014) [3]. India is second largest producer of potato after China and contributes around 11% of world potato production. It is also considered as the major cash crops that are grown to satisfy the food demand and to improve the living standard of the farmers (Shijie, 2011) [4]. In India potato is cultivated on an area about 2340.46 thousand hectares with production of 58994.40 thousand MT. As far as Uttarakhand is concern, potato is cultivated on an area about 26.87 thousand hectares with production of 367.31 thousand MT (Anonymous, 2023-24) [1]. Potato is a major food- security crop that can substitute for cereal crop considering its high yield and great nutritive value (Zhang, 2017) [7]. However, major problems in potato cultivation include weeds, diseases, optimum temperature, optimum moisture etc. (Bhart and Rakesh, 2021) [2]. Among the various practices we can use mulching to reduces this problem. Mulch creates a barrier between the soil and the atmosphere, which helps to decrease evaporation. However, mulch can also prevent water from reaching the soil by absorbing or blocking water from light rains and overly thick layers of mulch can reduce oxygen in the soil. Mulch reflects the solar radiation which help in reducing the soil temperature, keeping it cooler and prevent evaporation. It also helps in reducing the soil erosion and reduces wilt and late blight incidences. So, the present investigation was initiated to find out a suitable mulching material and cultivar for higher potato production under foot hills of Himalayas.

Materials and Methods

An experiment was conducted during the *Rabi* season of 2022-2023 at the Agriculture Farm of Gaulapar, dist-Nainital, Uttarakhand to find out the "Effect of organic and inorganic mulch material on different varieties of potato (*Solanum tuberosum* L) in foot hills of Uttarakhand. The experimental site is located at Himalayan foothills of Bhabar region and situated near the banks of Gaula River. As far as soil is concern, the soil was sandy loam with a pH of 6.54.

The experiment was laid out in split plot design (SPD) which consisted of main plot treatments of mulches such as black polythene sheet (M_1), organic mulch (M_2) and no much (M_3) which was control. The sub plot treatments consisted of 4 different varieties such as of potato which are suitable for cultivation in the foot hills of Uttarakhand Kufri Badshah (V_1), Kufri Chandramukhi (V_2), Kufri Sindhuri (V_3) and Gola (V_4). Based on gross plot size, a uniform dose of nitrogen @ 180 kg/ ha through Urea, phosphorus @ 80kg /ha through S.S.P. and potassium @ 110 kg /ha through MOP was applied to all treatment. The half quantity of nitrogen and full quantity of phosphorus and potassium were broadcasted in the field during final field preparation. The rest half dose of nitrogen was top dressed in two splits, after first and second irrigation of the crop. A plastic mulch having 20-micron thickness, black (as per treatments) in colour was spread on soil plot wise, covering it tightly with sufficient soil from all the four sides. A three-inch-wide strip was cut apart horizontally over the entire row zone for emergence of potato plants.

Potato tubers variety Kufri Jyoti, Kufri Chandramukhi, Kufri Sindhuri, Gola were cut into pieces of 30-50 g and treated with fungicide (carbendazim @ 2.5 g/l of water for 30 minutes) and planted in well prepared soil on 30/10/2022. Planting was done at a spacing of 60 cm row to

row and 20 cm plant to plant in flat beds or ridges made manually as per the treatment. The first irrigation was given to each plot on 24/11/2022 and second irrigation was given to each plot on 27/12/2022.

For data collection 5 plants was randomly selected from each plot excluding border plants were used to measure various growth and yield parameters. Hand weeding of the experimental field was done at the time of earthing up with the help of khurpi at 30 days after planting (DAP) to avoid the competition in the field among the potato varieties. First earthing up was done at two weeks after full emergence. Second earthing up was done 45 days after full emergence. Haulm cutting was done on 17/1/2022 or 75 DAP. Haulms were cut from the ground leaving the remaining portion as such under the ground.

Different growth, yield and economics parameters were taken. Growth parameters of the plants like emergence after 30 days after planting, plant height 30 and 60 days after planting, number of shoots per plant and yield parameters like number of tubers per plant, number of defected tubers, tuber weight per plant(kg/plot), tuber yield per plot (kg/ha.), tuber yield per hectare and economics parameter.

Results and Discussion

Growth attributing character

The observation studied under growth characters are emergence 15 days after planting, plant height 30 and 60 days after planting (cm) and number of shoots per plant.

Emergence 15 days after planting

Among the Potato variety Kufri Chandramukhi (V_3) (92.110%) was recorded highest over Gola (V_1) (89.667%). It was found to be non-significant. Among the mulching material inorganic mulch (M_1) (93.683%) recorded significantly higher emergence over control (M_3) (87.250%) however, organic mulch (M_2) (92.808%) being at par with inorganic mulch.

Plant height (cm.)

Among the potato varieties Kufri Badshah (V_2) (35.688cm) was recorded with significantly higher plant population over Kufri Sindhuri (V_4) (26.917cm). However, Gola (V_1) (34.016cm), Kufri Chandramukhi (V_3) (34.842cm) were being at par with Kufri Badshah. Among the mulching material recorded at 30 days after planting (DAP), inorganic mulch (M_1) (36.982cm) recorded highest plant height over organic mulch (M_2) (27.967cm.). Interaction between varieties and mulching was significantly highest in M_2V_2 (41.107). Among the Potato varieties Kufri Badshah (V_2) (54.160cm.) recorded highest plant population over Kufri Sindhuri (V_4) (48.862cm). Among the mulching material recorded at 60 days after planting (DAP), inorganic mulch (M_1) (54.805cm) recorded highest plant height over organic mulch (M_2) (43.192cm.) and control M_3 (53.373), however organic mulch (M_2) (92.808%) being at par with inorganic mulch.

Number of shoots per plant

Among the Potato varieties, Kufri Sindhuri (V_4) (18.589) was recorded significantly higher number of shoots over Gola (V_1) (15.628). However, Kufri Chandramukhi (V_3) (17.356) being at par with Kufri Sindhuri (V_4)**.** Among the mulching material recorded inorganic mulch (M_1) (18.375) recorded significantly higher number of shoots over organic mulch (M_2) (15.133). Interaction between mulching and varieties was found to be non-significant.

Number of tubers per plant

Among the Potato varieties, Kufri Sindhuri (V_2) (9.111) was recorded highest number of tubers per plant over Kufri Badshah (V_2) (8.600). It was found to be non- significant. Among the mulching material inorganic mulch (M_1) (10.125) recorded significantly higher number of tubers per plant over control (M_3) (7.825). However, organic mulch (M_2) (8.308) being at par with inorganic mulch (M_1). Interaction between varieties and mulch was found to be non-significant.

Number of defected tubers

Among the potato variety Gola (V_1) (1.422) was recorded highest number of defected tubers over Kufri Chandramukhi (V_3) (1.367). It was found to be non-significant. Among the mulching material control (M_3) (1.850) was recorded significantly highest number of defected tubers over inorganic mulch (M_1) (1.000). Interaction between varieties and mulching was found to be non-significant.

Weight of tubers per plant

Among the Potato variety Gola (V_1) (0.717) was recorded with higher weight of tuber per plant population over Kufri Sindhuri (0.450). It was found to be non-significant. Among the mulching material inorganic mulch (M_1) (0.737) recorded significantly higher weight of tuber per plant over control (M_3) (0.372). However, organic mulch (M_2) (0.574) being at par with inorganic mulch (M_1). Interaction between varieties and mulch was found to be non-significant.

Among the Potato variety Kufri Badshah (V_2) (12.305) recorded highest weight of tuber per plot over Kufri Sindhuri) (V_4) (10.053). It was found to be non-significant. Among the mulching material organic mulch (M_2) (11.986) recorded significantly higher weight of tuber per plot over control (M_3) (9.143). However, Inorganic mulch (M_1) (11.953) being at par with organic mulch. Interaction between Varieties and Mulch was found to be non-significant.

Yield tonnes ha^{-1}

Among the potato variety Kufri Badshah (V_2) (36.904t ha^{-1}) recorded highest yield (tonnes/ha.) over Kufri Sindhuri (30.139 t ha^{-1}). It was found to be non-significant. Among the mulching material organic mulch (M_2) (36.014t ha^{-1}) recorded significantly higher yield of tuber over control (M_3) (27.478t ha^{-1}). However, inorganic mulch (M_1) (35.658) being at par with organic mulch (M_2). Interaction between Varieties and Mulch was found to be non-significant

Conclusion

Based on above mentioned investigation under foot hills of Uttarakhand, it could be concluded that varieties have been least effect on yield parameters. Inorganic Mulch has positive effect on emergence, plant height, tuber yield and other yield parameters. To earn maximum profit, variety Kufri Badshah and inorganic mulch may be grown under

foot hills of Uttarakhand.

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