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Impact of Organic and Inorganic Synthetic Mulches on Growth and Yield of Potato under Temperate Conditions

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ABSTRACT: The growth and yield of potato largely depends on the soil, climate conditions and different production practices. A part from using high yielding varieties and good agricultural practices there is a need to utilize environmental, biological energy for higher production. Mulching is an important production practice which greatly influences potato yields through moisture retention, maintenance of soil temperatures, weed control and disease control. A field experiment was conducted during 2020-2021 at Experimental Farm of Division of Vegetable Science, SKUAST-K, Shalimar to study the effect of different organic and inorganic synthetic mulches on growth and yield of potato variety, Shalimar Potato-1. The experiment was laid out in RCBD design with ten treatments and three replications. Observation were recorded on various parameters related to growth and yield. Among all the inorganic synthetic mulches, treatment (T_1) Black P.M recorded maximum germination percentage (94.30%), plant height (80.66cm), plant spread (57.24cm), leaf area (82.16cm^2), number of leaves plant^{-1} (120.33), number of shoots plant^{-1} (7.73), number of tuber per plant (23.00), average tuber weight per plant (0.750kg), marketable tuber yield plot^{-1} (31.72kg) and total yield (496.86q ha^{-1}). Similarly, in case of the organic mulches, treatment (T_9) Farmyard manure mulch recorded maximum germination percentage (90.67%), number of shoots (6.50) plant^{-1}, however, T_8 Rice straw mulch recorded maximum plant height (74.70 cm), plant spread (52.86cm), leaf area (61.55cm^2), number of leaves plant^{-1} (96.0), number of tubers (16.68) plant^{-1}, average tubers weight plant^{-1} (0.438 kg), marketable tubers plot^{-1} (13.42kg) and total yield (275.68q ha^{-1}). From the above mentioned investigation, it can be concluded that in case of inorganic mulch, utilizing Black polythene and in case of organic mulch, Rice straw can raise the temperature and moisture around the root zone and control the weeds to get the highest and fastest rate of emergence of potato seed tubers as well as growth and yield parameters than bare soil.

Keywords: Organic, Inorganic, Synthetic, Mulch.

INTRODUCTION

Potato (*Solanum tuberosum* L.) belonging to Solanaceae family is an important food crop of India, where China is the largest potato producer and almost one third of the world's production comes from China and India (FAOSTAT, 2019). Growth of a potato plant occurs in several stages: germination, Stolon development, plant establishment, tuber initiation, tuber bulking, and tuber maturation. Being cool season crop, potato grows well in certain areas having cool climatic regime but the sprout development rate depends on temperature of soil (Al-Zohiri and Samy 2013). The optimum temperature of soil for initiating tubers is 16-19°C (Khan *et al.*, 2011). Growth and yield of potato were affected by using different organic and inorganic polythene mulches. According to Singh and Ahmed (2008), mulching shows significant influence on growth and yield of potato. Mulches function as cover crop and reduce tillage operations that have some ecological advantages over conventional land preparation tasks causing minimum alterations in soil environment (Ahmed *et al.*, 2017). Plastic mulches have various beneficial effects on crop production in arid regions, including crop earliness, crop cleanliness, prevent soil erosion, conservation of soil moisture as well as fertility and improving yield (Moreno & Moreno, 2008) and weed control (Hidayat *et al*., 2013). Plastic film mulching can save water (Lie *et al*., 2004), modify the soil temperature (Hou *et al*., 2010; Filipovic *et al*., 2016) and accelerate plant growth (Qin *et al*., 2016; Fan *et al*., 2017). Mulching also modifies the soil microclimate, favours seedling emergence and flowering time and suppress weed population (Campiglia *et al*., 2014). The application of grass mulch on surface of the row ensured increase of weight of marketable tuber and higher occurrence of tubers

(Dvorak *et al*., 2015). Utilizing plastic mulch in the winter is increasing the vegetative growth parameters, higher total yield and marketable yield (Al-Zohiri and Samy 2013). Application of mulch, Beside of higher yield, also increased the yield of B and C grade tubers along with tuber numbers as compared to non-mulch condition (Begum & Mrinal, 2014). Incorporation of black polythene was found to be superior to paddy husk mulch and no mulch in bell pepper (Kumari *et al*., (2009). According to Ahmed *et al.*, (2017), the highest yield was found in the black polythene mulch that was statistically different from other mulch treatments. Increase in potato yield under black film was significantly higher than under transparent film when air temperature was over 20°C (Li *et al.*, 2018). Different types and colours viz. black, green, yellow, blue, grey and red plastic mulch have characteristics optical properties that change the levels of light radiation reaching to the soil, causing increases or decreases in the soil temperature and moisture. Organic mulches have also shown positive effects on growth, yield and earliness due to soil heating. However, organic mulches have to be renewed periodically to maintain their effects because they decompose with time. In general soil mulching implies a high economic cost factor since the materials are not often available within the farm and have to be purchased elsewhere, transported to the site and installed on the plots. The objectives of the present work was to determine the effect of different type of organic (Pine needle, Rice straw and Farmyard manure) and inorganic (various coloured plastic) mulches on growth and yield of potato under temperate conditions.

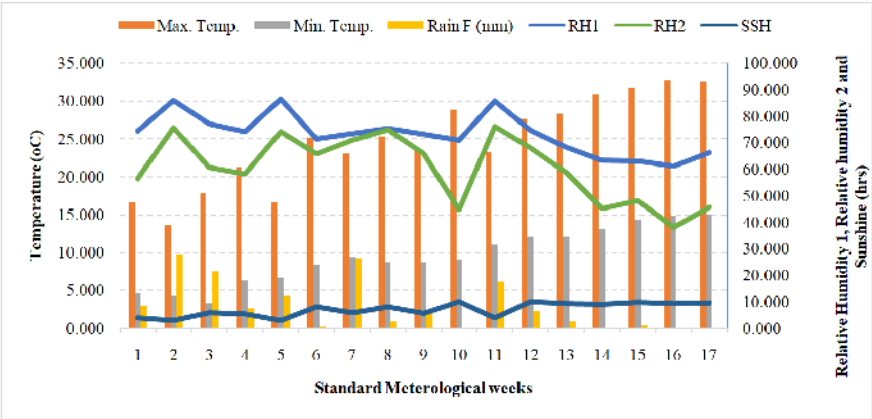
MATERIAL AND METHODS

Site description

The experiment was conducted on sandy clay loam soil at experimental field of Division of Vegetable Science, SKUAST Kashmir Shalimar during Kharif 2020, to investigate the Impact of Different Organic and Inorganic Synthetic Mulches on Growth and Yield of Potato (*Solanum tuberosum* L.) Under Temperate Conditions. The site is located at the main campus, Shalimar, Srinagar which is 15 km away from Srinagar city. The altitude of the location is 1685 meter above mean sea level and situated 34^{o} N of latitude and 74.89^{o} E of longitude.

Climate and weather conditions

The experimental site falls in a mid to high altitude characterized by hot summers and very cold winters. The mean minimum and maximum temperatures are recorded in the months of January and June (respectively). The maximum rain fall is received during March to April. The minimum and maximum temperature ranging between -1.47 to 30.75°C, exhibits considerable fluctuation both in summer and winter. The average relative humidity during the crop season was between 55.68 to 58.83 percent.



(Source: Meteorological observatory, Division of Agro-metrology, SKUAST-Kashmir)

Fig. 1. Meteorological data of Shalimar during cropping season (2020).

Average sized seed tubers (25-35gm per seed tuber) of variety Shalimar Potato-1 were sown on 19th March, 2020 with 60 × 20 cm spacing. Before sowing, field was tractorized and the soil was brought to fine tilth. One deep plowing and 3 light plowing followed by harrowing was done for field preparation. The recommended dose of fertilizers for potato FYM @20-25 ton ha^{-1}, N: P2O5: K2O @ 150:100:100 kg ha^{-1} were applied. All the above-mentioned fertilizer doses were incorporated into the field before sowing. Due to mulches on the field, full dose of nitrogen was given as the basal dose at the time of sowing.

Experimental design. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications and ten treatments viz. T_1 = Black Polythene Mulch, T_2 = Green Polythene Mulch, T_3 = Blue Polythene Mulch, T_4 = Yellow Polythene Mulch, T_5 = Grey Polythene Mulch, T_6 = Red Polythene Mulch,

T_7 = Pine Needle Mulch, T_8 = Rice Straw Mulch, T_9 = Farmyard Manure Mulch and T_{10} = Control (No mulch). The thickness of organic and inorganic plastic mulches were 2 inches and 30 Micron respectively. The individual plot size was 3.6 × 2 m with 6 rows per plot and 8 plant per row. For Data collection randomly selected 5 plants from each plot excluding border plants were used to measure various growth and yield parameters. All data collected were subjected to analysis of variance (ANOVA) was computed and the mean were compared by using Dunkan's Multiple Range Test (DMRT) at 5% level of significance (Gomez and Gomez (1984).

RESULT AND DISCUSSION

Effects of different mulch materials (organic and inorganic polythene mulches) on the Growth and yield parameters

Germination percentage, plant height and plant spread were significantly influenced by different organic and inorganic polythene mulches (Table 1). Black P.M (T_1) recorded maximum germination percentage (94.30%) which was at par with the rest of polythene mulches, plant height (80.66cm) and plant spread (57.24cm) respectively. Likewise in case of organic mulches, maximum germination percentage (90.67%) was recorded with Farmyard Manure mulch (T_9) followed by (T_8) Rice straw mulch (90.16%) which was non-significant differences for germination percentage among each other. Similarly, among the organic mulches (T_8) Rice straw mulch produced significantly taller (74.70cm) and maximum plant spread (52.86cm) respectively. Significantly lowest germination percentage (87.40%), plant height (63.76cm) and plant spread (37.40cm) were recorded under no mulch i.e. Treatment (T_{10}). The maximum germination percentage and highest plant height and plant spread were obtained in Black P.M (T_1), that may be attributed to rising soil temperature and conservation of more moisture in the black polythene covered soil that accelerated the germination and emergence of potato. Besides, mulching provides favorable physio-chemical conditions of soil like good soil aeration, porosity, water holding capacity, better availability of nutrients. Plastic mulching also encourage plant emergence through good light transmittance. Thus, most of the solar radiation passing through plastic film are directly absorbed by the soil resulting in increasing soil surface temperature. These results were in agreement with those reported by Li *et al.*, (2018); Al-Zohiri and Samy (2013); Zhao *et al.*, (2012); Ferdoushi *et al.*, (2010), Singh and Ahmed (2008), Balasubramani and Palaniappan (2001); Ruiz *et al.*, (1999). Similarly, the increase in plant height and plant spread might be due to better availability of soil moisture and optimum soil temperature provided by plastic mulches as well as straw much. The colour of the plastic mulches may differentially affect the temperature of soil due to the effect of the colour on light transmission. The findings were in agreement with Farrag *et al.*, (2016) who reported that the use of black polyethylene mulch as well as straw much resulted in significantly higher values of plant height. Similar result with application of black plastic was reported by the research carried by (Ahmed *et al.*, 2017); Ashrafuzzaman *et al.*, (2011) who reported that, the tallest plant (78.45cm) was observed in Transparent, followed by black (77.58cm) and blue (77.03cm) plastic in Chilli respectively.

Table 1: Germination percentage (%) at 45 days after planting, plant height (cm) and Plant spread (cm) of potato as affected by different organic and synthetic coloured mulches.

Treatments	Germination percentage (%)	Plant height (cm)	Plant spread (cm)
	Mean ±Sd	Mean ±Sd	Mean ±Sd
T_1 Black Polythene Mulch	94.30±0.63^{b}	80.66±0.57^{h}	57.24±0.56^{c}
T_2 Green Polythene mulch	94.30±0.65^{b}	77.34±0.15^{e}	56.66±0.44^{c}
T_3 Blue Polythene mulch	94.30±1.19^{b}	78.50±0.50^{f}	56.29±0.65^{c}
T_4 Yellow Polythene mulch	94.30±0.73^{b}	77.66±0.30^{ef}	56.32±0.16^{c}
T_5 Grey Polythene mulch	94.30±0.70^{b}	79.60±0.36^{g}	57.21±0.63^{c}
T_6 Red Polythene mulch	94.30±0.99^{b}	79.83±1.04^{gh}	56.78±2.94^{c}
T_7 Pine Needle mulch	90.06±0.47^{ab}	65.5±0.50^{b}	51.97±1.75^{b}
T_8 Rice straw mulch	90.16±0.72^{ab}	74.70±0.26^{d}	52.86±0.52^{b}
T_9 Farmyard manure mulch	90.67±1.01^{ab}	67.56±0.40^{c}	51.27±0.58^{b}
T_{10} Control (no mulch)	87.40±0.95^{a}	63.76±0.25^{a}	37.40±1.15^{a}
C.D (p≤0.05)	**2.437**	**0.788**	**1.82**
S.E (d)	**1.151**	**0.372**	**0.6**

Mean values with same letters don't differ significantly

Data on leaf area (cm^2), number of leaves $plant^{-1}$ and number of shoots $plant^{-1}$ as affected by different organic and inorganic polythene mulches is presented in (Table 2). The analysis revealed that different mulches caused significant variation. Among the coloured synthetic mulches (T_1) Black P.M resulted in maximum leaf area ($82.16cm^2$), number of leaves (120.33) and number of shoots (7.73) $plant^{-1}$ respectively. However, in case of organic mulches maximum leaf area ($61.55cm^2$) and number of leaves (96.00) were recorded with (T_8) Rice

straw mulch respectively. Maximum number of shoots (6.50) plant^{-1} was recorded with (T_9) Farm yard manure mulch followed by (T_8) Rice straw mulch (6.33). Significantly lowest leaf area (44.57cm^2), number of leaves (56.53) and number of shoots (5.07) plant^{-1} were recorded under no mulch i.e. Treatment (T_{10}). Higher leaf area could probably be attributed by more number of leaves and shoots per plant, resulting in higher photosynthetic activity and more production of photosynthates and ultimately their translocation to the sink. Also, the synthetic mulches improve the plant microclimate which lead to better growth and development. Secondly, it helps to reduce the evaporation and maintain proper moisture content due to which maximum number of leaves is found at mulching as compared to non-mulching. Thirdly, the increase in number of leaves per plant and number of shoots per plant under plastic mulches treatment might be due to enhanced by preservation of moisture and optimum temperature which enables the plant to uptake more nutrient for better growth and development. Similar observations with respect to number of leaves per plant was also reported by Singh *et al*., (2005) in tomato, with respect to maximum number of leaves in mulching as compared to non-mulching was reported by Dong, (2014) in potato. Rajablariani *et al*., (2012) also reported that number of leaves and shoots per plant were better for plant grown under plastics compared to bare soil in tomato. Bhatt *et al*., (2011) also obtained the same result in summer squash.

Table 2: Leaf area (cm^2), Number of leaves plant^{-1} and Number of shoots plant^{-1} as affected by different organic synthetic coloured mulches.

Treatments	Leaf area (cm^2)	Number of leaves plant^{-1}	Number of Shoots plant^{-1}
	Mean ±Sd	Mean ±Sd	Mean ±Sd
T_1 Black Polythene Mulch	82.16±1.96^{d}	120.33±1.52^{g}	7.73±0.15^{e}
T_2 Green Polythene mulch	77.73±1.81^{d}	114.66±1.52^{ef}	7.40±0.00^{de}
T_3 Blue Polythene mulch	77.13±2.01^{d}	118.00±3.60^{fg}	7.16±0.20^{d}
T_4 Yellow Polythene mulch	76.50±1.32^{d}	113.66±2.08^{e}	7.11±0.29^{d}
T_5 Grey Polythene mulch	80.10±1.15^{d}	117.33±2.51^{fg}	7.13±0.23^{d}
T_6 Red Polythene mulch	80.83±0.76^{d}	118.00±1.00^{fg}	7.43±0.20^{de}
T_7 Pine Needle mulch	47.04±1.46^{ab}	87.33±1.52^{b}	6.10±0.10^{b}
T_8 Rice straw mulch	61.55±10.39^{c}	96.00±1.00^{d}	6.33±0.28^{bc}
T_9 Farmyard manure mulch	51.55±1.89^{b}	92.00±1.00^{c}	6.50±0.10^{c}
T_{10} Control (no mulch)	44.57±0.21^{a}	56.53±2.15^{a}	5.07±0.05^{a}
C.D ($p \leq 0.05$)	**6.31**	**3.508**	**0.327**
S.E (d)	**2.98**	**1.657**	**0.155**

Mean values with same letters don't differ significantly

Perusal data presented in (Table 3) revealed significant effect of different mulch treatments on yield attributes of potato. Among the coloured synthetic mulches (T_1) Black P.M resulted in maximum number of tubers (23.00) plant^{-1} followed by (T_3) Blue P.M (21.23), average tuber yield (0.750 kg) plant^{-1}, weight of marketable tuber (31.72) plot^{-1} followed by Red P.M (30.64) and total yield (496.86q.h^{-1}) followed by Red P.M (480.27q ha^{-1}) respectively. Minimum weight of unmarketable tubers (3.44kg) plot^{-1} was recorded with (T_2) Green P.M. Further, organic mulches differed significantly with all other treatments. Maximum (17.16) number of tubers was recorded with (T_7) Pine needle mulch followed by (T_8) Rice straw mulch (16.68). Maximum average yield of tuber (0.438 kg) plant^{-1}, weight of marketable yield (13.42) plot^{-1}, weight of unmarketable yield (6.43kg) plot^{-1} and total yield (275.66 q.ha^{-1}) were recorded with (T_8) Rice straw mulch respectively. Significantly lowest number of tubers (11.33) plant^{-1}, average yield of tuber (0.240 kg) plant^{-1}, weight of marketable yield (8.03) plot^{-1} and total yield (166.20 q ha^{-1}) were recorded under no mulch i.e. Treatment (T_{10}).Significantly higher tuber yield per plant, per plot and per hectare obtained under (T_1) Black P.M as compared to organic mulches and bare soil could be attributed to the available congenial temperature during its vegetative growth, tuber formation and their development. Besides, more number of tubers plant^{-1}, number of shoots plant^{-1} and leaf area may have resulted in improved yields. Also, increased vegetative growth represents the increased capacity to mobilize and translocate the photosynthates to the organs having economic utility (sink). Further, the soil ensures the maximum nutrient uptake by the plant because of less weed competition and better moisture conserving condition and also the results support hypothesis that yield differences associated with colored plastic mulches were due to differences in the spectral characteristics of reflected light which differ from one to another. Generally, film has good light transmittance. Thus, most of the solar radiation can passing through film, can be directly absorbed by the soil which leads in increasing the topsoil temperature. The improvement of top soil temperature create favorable conditions for seed germination (Zhao *et al*., 2014). Increased emergence rates and strong seedling establishment result in vigorous growth and high potato yields. Organic mulches also showed good results. Treatment (T_8) Rice straw mulch registered maximum values of 0.438 kg average tuber yield

plant^{-1}, 19.85 kg yield plot^{-1} and 275.96 q ha^{-1} total yield respectively which was highest over other organic treatments. The increased yield attributes of crop might be the reason for increase in average tuber yield per plant, yield per plot and total yield. Polythene mulches were found more beneficial in increasing these parameters as compared to organic mulches as the soil area covered with polythene sheet does not allow the weeds to emerge and grow which finally resulted in better tuberization. These results were in harmony with the results of Li *et al*., (2018); Ahmed *et al*., (2017); Adamchuk *et al*., (2016); Al-Zohiri and Samy (2013); Ferdoushi *et al*., (2010); Singh and Ahmed (2008), Rahman (2005); Rahman *et al*., (2004), who reported that plastic and straw mulching significantly increased potato yield. The increase in marketable yield under synthetic mulched plots can be probably associated with the conservation of moisture and improved microclimate both beneath and above the soil surface, maximum weed control and favorable temperature for better emergence. These research findings are in conformity with the findings of (Al-Jubouri, 2011 on potato and Al-Juboori, 2013) on garlic.

Table 3: Number of tubers plant^{-1}, Average tuber weight plant^{-1} (Kg), Weight of marketable tubers plot^{-1} (Kg) and Weight of unmarketable tubers plot-1 (Kg) as affected by different organic and synthetic coloured mulches.

Treatments	Number of tubers plant^{-1}	Average tuber weight plant $^{-1}$ (Kg)	Weight of marketable tubers plot^{-1} (Kg)	Weight of unmarketable tubers plot^{-1} (Kg)	Total yield (q ha $^{-1}$)
	Mean ±Sd	Mean ±Sd	Mean ±Sd	Mean ±Sd	Mean ±Sd
T_1 Black Polythene Mulch	23.00±0.50^{f}	0.750±0.01^{h}	31.72±0.193^{g}	4.05±0.049^{b}	496.86±1.04^{j}
T_2 Green Polythene mulch	16.53±0.68^{c}	0.580±0.004^{e}	24.51±0.214^{de}	3.44±0.098^{a}	387.54±1.18^{f}
T_3 Blue Polythene mulch	21.23±0.25^{e}	0.727±0.009^{g}	29.75±0.119^{f}	4.04±0.019^{b}	469.02±1.02^{h}
T_4 Yellow Polythene mulch	17.46±0.50^{d}	0.578±0.002^{e}	23.31±0.140^{d}	4.21±0.023^{b}	382.53±0.60^{e}
T_5 Grey Polythene mulch	21.00±0.50^{e}	0.602±0.003^{f}	25.76±0.125^{e}	6.11±0.025^{d}	442.60±0.53^{g}
T_6 Red Polythene mulch	21.00±1.00^{e}	0.747±0.004^{h}	30.64±0.172^{fg}	3.93±0.120^{b}	480.27±1.12^{i}
T_7 Pine Needle mulch	17.16±0.28^{d}	0.352±0.005^{c}	10.35±0.090^{b}	5.15±0.617^{c}	215.27±1.31^{b}
T_8 Rice straw mulch	16.68±0.27^{d}	0.438±0.002^{d}	13.42±2.58^{c}	6.43±0.045^{d}	275.66±1.48^{d}
T_9 Farmyard manure mulch	12.66±0.28^{b}	0.325±0.002^{b}	12.31±0.212^{c}	3.84±0.025^{b}	224.41±0.52^{c}
T_{10} Control (no mulch)	11.33±0.28^{a}	0.240±0.007^{a}	8.03±0.233^{a}	3.94±0.017^{b}	166.20±0.60^{a}
C.D (p≤0.05)	**0.924**	**0.010**	**1.44**	**0.36**	**1.639**
S.E (d)	**0.437**	**0.005**	**0.679**	**0.171**	**0.774**

Mean values with same letters don't differ significantly

Data on Grade wise number of tubers per plant as affected by different organic and inorganic mulches is presented in (Table 4). The analysis revealed significant variation in Grade wise number of tuber per plant among different organic and inorganic mulches. Maximum A grade sized number of tuber(3.00) plant^{-1}and Grade C sized number of tubers (9.40) plant^{-1} were recorded under (T_1) Black P.M respectively. Maximum B grade sized number of tuber (4.23) plant^{-1} followed by (T_1) Black P.M. likewise, maximum number Grade D sized number of tubers per plant (8.00) was recorded in (T_5) Grey P.M. Further, among the organic mulches, maximum grade A sized number of tubers (1.72) plant^{-1}, grade B sized number of tubers (1.70) plant^{-1}were recorded under (T_8) Rice Straw mulch, While, maximum grade C number of tuber (4.45) plant^{-1} and grade D (10.00) plant^{-1} were recorded under (T_7) Pine needle mulch respectively. Significantly minimum A, B and C grade sized tuber per plant were recorded with (T_{10}) no mulch. However the minimum D grade sized tuber was recorded with (T_9) Farmyard manure mulch. The highest 'A', 'B' and 'C' grade tubers could be attributed to congenial growing conditions under mulching which led to enhanced absorption of nutrients by the crop resulting in increased tuber production. Further, such response can be due to the physiochemical and biological improvement in the soil due to favorable temperature and better moisture regimes: The enhanced nutrient availability and microbial activity in mulch conditions especially in early growing stage helps in more number of stolon formation and the increased nutrient uptake lead to the better development that leads to improved size and weight of tubers. The above results are in accordance with the findings of Ahmad, (2017); Begum and Saikia (2014). Application of mulches also increased the 'C' and 'D' grade tuber. This might be due to rainfed condition in which no irrigation was applied and the tubers remained undersized because irrigation is required in the critical stages of crop. In case of organic mulch (T8) Rice straw mulch also showed somewhat increase in 'A' grade sized tuber as compared to rest of organic mulches and control which might be due to cooling effect on the soil, soil moisture conservation, reduced annual weed production and return of nutrients to soil through decomposition. Application of polythene mulches were found more beneficial over organic mulches as polythene mulches can offer a barrier against weeds, moisture loss, nutrient loss and erosion which might be the reason of increasing A grade sized

tuber under polythene mulches. Similar response was observed by Dıaz-Pe´rez (2010) in bell pepper grown on plastic film mulches and recorded the maximum fruit yield under black polythene mulch.

Table 4: Grade A, B, C and D sized number of tubers plant^{-1} as affected by different organic and synthetic coloured polythene mulches.

Treatments	Grade A : >75g	Grade B : 50-75g	Grade C : 25-50g	Grade D : <25g
	Mean ±Sd	Mean ±Sd	Mean ±Sd	Mean ±Sd
T_1 Black Polythene Mulch	3.00±0.26^{d}	4.00±0.10^{f}	9.40±0.10^{i}	6.40±0.10^{c}
T_2 Green Polythene mulch	2.01±0.01^{bc}	3.73±0.25^{de}	5.70±0.26^{d}	4.00±1.00^{a}
T_3 Blue Polythene mulch	2.70±0.26^{d}	3.93±0.15^{ef}	6.40±0.10^{e}	7.50±0.20^{d}
T_4 Yellow Polythene mulch	2.16±0.28^{c}	3.70±0.10^{de}	6.90±0.10^{f}	5.00±0.10^{b}
T_5 Grey Polythene mulch	2.13±0.15^{c}	3.53±0.05^{d}	7.30±0.20^{g}	8.00±0.10^{d}
T_6 Red Polythene mulch	2.93±0.11^{d}	4.23±0.05^{g}	8.10±0.17^{h}	6.00±0.20^{c}
T_7 Pine Needle mulch	1.25±0.08^{a}	1.23±0.05^{b}	4.45±0.13^{c}	10.00±0.26^{f}
T_8 Rice straw mulch	1.72±0.02^{b}	1.70±0.20^{c}	4.30±0.26^{c}	9.00±0.50^{e}
T_9 Farmyard manure mulch	1.26±0.12^{a}	1.33±0.11^{b}	4.0±0.10^{b}	6.00±0.55^{c}
T_{10} Control (no mulch)	1.06±0.11^{a}	0.5±0.10^{a}	1.90±0.10^{a}	8.03±047^{d}
C.D (p≤0.05)	**0.302**	**0.242**	**0.298**	**0.637**
S.E (d)	**0.143**	**0.115**	**0.141**	**0.301**

Mean values with same letters don't differ significantly

CONCLUSION

The organic and inorganic plastic mulches exhibited a significant influence on all growth and yield parameters. Germination percentage was found non-significant among the different types of mulches But was found significant with treatment T_{10} (no mulch). Black P.M recorded significant increase in plant height, plant spread, leaf area, number of shoots plant^{-1} over rest of the mulches and control as well. Number of tubers plant^{-1}, Average tuber weight plant^{-1}, grade wise weight and number of tubers plant^{-1} were found significantly higher under Black P.M as compared to other coloured mulches, organic mulches and bare soil. Total tuber yield also remained significantly higher with Black P.M compared to organic mulches and bare soil. Among organic mulches rice straw mulch recorded significant increase in growth and yield parameters as compared to other organic and un-mulched soil. Furthermore, it is suggested to conduct multi-location and multi-seasonal trials on this aspect to achieve more accurate results.

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Conflict of Interest. None .

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