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PHYSICO-CHEMICAL CHARACTERISTICS OF SOIL AND ECONOMICS OF POTATO AS AFFECTED BY MULCHING UNDER KASHMIR CONDITIONS

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INTRODUCTION

Potato (*Solanum tuberosum* L.) is a staple food in India. Considering the trend of population growth and consequently the increased demand for the food in the world and dwindling cultivable land area, the potato is likely to play an important role in the future. Growth of a potato plant occurs in several stages: germination, Stolon development, plant establishment, tuber initiation, tuber bulking, and tuber maturation. Plastic mulches have various beneficial effects on crop production including crop earliness, crop cleanliness, prevent soil erosion, conservation of soil moisture as well as fertility and improving yield (Moreno and Moreno, 2008) and weed control (Hidayat *et al*., 2013). Mulch is a preventive layer covering the surface of the soil and can be done with both organic and inorganic materials (Sharma and Bhardwaj, 2017). Plastic film mulching can save water, modify the soil temperature and accelerate plant growth (Fan *et al*., 2017). Mulching also affects the soil micro-climate encouraging seedling emergence and blooming period while suppresses weed intensity. Shahjahan *et al*. (2018) has found that black polythene mulch improves quality parameters than bare land production systems and Agrawal *et al.* (2010), suggests use of red plastic mulches for harnessing higher net income and benefit cost ratio in tomato as compared to non-mulched conditions. Further, different types and colors viz. Black, Green, yellow, Blue, Grey and Red of 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.

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 which is located 15 km away from Srinagar city and 1685 meter above MSL.

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%.

Treatment Details and 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 inorganic plastic mulches was 30 Micron and organic mulch was spread up to the thickness on 2 inches. The individual plot size was 3.6 × 2 m with 6 rows per plot and 8 plants per row.

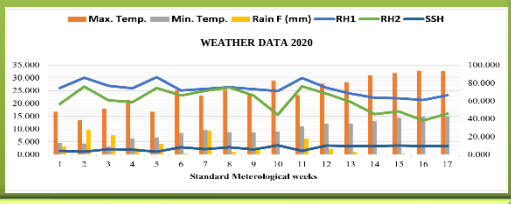

Table 1. Yield and related attributes as affected by different organic and synthetic coloured mulches

Treatments	Average tuber weight plant^{-1} (Kg)	Weight of marketable tubers plot^{-1} (Kg)	Total yield (q. ha^{-1})
	Mean ±Sd	Mean ±Sd	Mean ±Sd
T1	0.750±0.01h	31.72±0.193g	496.86±1.04j
T2	0.580±0.004e	24.51±0.214de	387.54±1.18f
T3	0.727±0.009g	29.75±0.119f	469.02±1.02h
T4	0.578±0.002e	23.31±0.140d	382.53±0.60e
T5	0.602±0.003f	25.76±0.125e	442.60±0.53g
T6	0.747±0.004h	30.64±0.172fg	480.27±1.12i
T7	0.352±0.005c	10.35±0.090b	215.27±1.31b
T8	0.438±0.002d	13.42±2.58c	275.66±1.48d
T9	0.325±0.002b	12.31±0.212c	224.41±0.52c
T10	0.240±0.007a	8.03±0.233a	166.20±0.60a
C.D (p≤0.05)	0.010	1.44	1.639
S.E (d)	0.005	0.679	0.774

Table 2. Soil physico-chemical characteristics as affected by different organic and synthetic coloured mulches

Treatments	pH	Electrical conductivity (ds. m^{-1})	Bulk density (g. cm^{-3})
	Mean ±Sd	Mean ±Sd	Mean ±Sd
T1	6.31±0.0058^{c}	0.140±0.0100^{a}	1.31±0.0055^{b}
T2	6.33±0.0161^{cd}	0.206±0.0010^{c}	1.30±0.0060^{a}
T3	6.34±0.0095^{d}	0.203±0.006^{c}	1.32±0.0043^{c}
T4	6.33±0.0095^{cd}	0.170±0.010^{b}	1.33±0.0043^{d}
T5	6.32±0.0119^{c}	0.154±0.001^{ab}	1.33±0.0045^{d}
T6	6.34±0.0095^{d}	0.210±0.010^{c}	1.32±0.0045^{c}
T7	6.23±0.0070^{a}	0.302±0.0130^{d}	1.40±0.0065^{f}
T8	6.38±0.0015^{e}	0.157±0.0002^{b}	1.38±0.0055^{e}
T9	6.25±0.0015^{b}	0.140±0.0100^{a}	1.32±0.0045^{c}
T10	6.55±0.0020^{f}	0.303±0.015^{d}	1.43±0.0043^{g}
C.D (p≤0.05)	0.013	0.016	0.008
S.E (d)	0.006	0.007	0.004
Initial status	6.61	0.183	1.50

Table 3. Nutrient availability after harvest as affected by different organic and synthetic coloured mulches

Treatments	Available Nitrogen	Available P_2O_5 (kg.ha^{-1})	Available K_2O (kg.ha^{-1})
	Mean ±Sd	Mean ±Sd	Mean ±Sd
T1	300.9±0.529^{e}	22.50±0.20^{b}	184.3±0.72^{f}
T2	300.49±0.54^{de}	22.24±0.39^{b}	183.7±0.60^{ef}
T3	299.16±0.76^{cd}	22.30±0.42^{b}	182.00±0.50^{c}
T4	300.22±0.38^{de}	22.22±0.52^{b}	183.57±0.12^{ef}
T5	298.20±1.00^{bc}	22.30±0.60^{b}	182.21±0.61^{cd}
T6	301.31±1.48^{e}	22.25±0.47^{b}	183.42±0.51^{ef}
T7	297.00±1.00^{b}	22.00±0.50^{ab}	180.32±0.27^{b}
T8	300.00±0.50^{de}	22.50±0.50^{b}	182.20±0.60^{cd}
T9	301.00±0.50^{f}	22.50±0.50^{b}	183.10±0.52^{de}
T10	255.50±0.50^{a}	21.260±0.38^{a}	173.90±0.52^{a}
C.D (p≤0.05)	1.395	N/A	0.848
S.E (d)	0.006	0.372	0.400
Initial status	229.76	20.00	165.21

Table 4. Relative economics of potato as affected by different organic and inorganic synthetic mulches

Treatment	Total cost of cultivation (Rs. ha^{-1})	Marketable yield (q ha^{-1})	Unmarketable yield (q ha^{-1})	Total yield (q ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	C:B ratio
T1	205101.21	440.55	56.11	496.86	925900.00	720798.79	4.51
T2	205101.21	340.41	47.71	387.54	718988.00	513886.79	3.50
T3	205101.21	413.19	55.83	469.02	871044.00	665942.79	4.24
T4	205101.21	323.00	58.47	382.53	692776.00	487674.79	3.38
T5	205101.21	357.77	84.86	442.60	783428.00	578326.79	3.82
T6	205101.21	425.55	54.58	480.27	894764.00	689662.79	4.36
T7	141695.0	143.75	71.52	215.27	344716.00	203021.00	2.43
T8	156695.0	186.38	89.30	275.66	444200.00	287505.00	2.83
T9	162195.0	170.97	53.33	224.41	384580.00	222385.00	2.37
T10	112195.0	111.52	54.72	166.20	266816.00	154621.00	2.38

CONCLUSION

Potato responded well to both organic and inorganic synthetic mulches under temperate condition of Kashmir valley. However, synthetic mulches proved superior than organic mulches and bare soil in terms of increasing yield, related attributes and physico-chemical characteristics of soil. Synthetic mulches were also found more profitable in terms of increasing net returns and benefit cost ratio as compared to organic mulches and unmulched soils. Thus mulching can be adopted for harnessing better and improved yields in potato under temperate conditions of Kashmir valley.

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