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Short Communication

Effect of plastic mulches on performance of brinjal (*Solanum melongena* L.) in temperate Himalaya

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The brinjal is a very important crop of Indian plains commonly grown throughout the year. A number of high yielding varieties and hybrids have been evolved to increase yield in this crop. In addition to improved cultivars, advances have also been made to develop cop management practices including fertilization, irrigation and weed control for boosting the productivity in this crop. Commercial cultivation of brinjal in hills is confined only to lower hills up to 1000-1200m altitude due to quick fall down of temperature in late Kharif and severe winter at higher altitudes (>15000m). The area under brinjal cultivation in mid hills (1700m-2200m altitude) of Himalayan region is negligible. However, selection of short duration long fruited varieties/hybrids have been found to give economical yield provided seedlings are raised in polyhouse during February-March and transplanted during the month of April. The peculiar feature of this crop in mid hills is that it is free from fruit rot disease and fruit-shoot borer infestation which are severe problems in plains and require frequent spray of long lasting pesticides which lead to health hazard. Such type of disease and insect avoidance in temperate hills opens the opportunity of organic brinjal production which could not be imagined in plains of India. Early fruiting, optimum moisture management during pre-monsoon period and weed management during monsoon are the crucial practices for success of this crop. Sowing of seeds during the month of February in polyhouse may lead to early transplanting of seedlings in the first week of April. Use of plastic mulches can be even more conducive for inducing earliness by increasing soil temperature (Hu et al. 1995 and Ramakrishna et al. 2006) and suppress weed population (Ossom et al. 2001) in addition to conserving soil moisture. With this view, black and white plastic mulches were applied and compared with unmulched control to assess the impact of different mulch treatments on edaphic environment, plant growth and productivity in addition to identify the suitable mulching option for micro-climatic manipulation leading to early and optimum yield by suppression of weed competition in summer-rainy brinjal crop in temperate Himalayas.

The experiments for present investigation were conducted in Vegetable Research Block of Veer Chandra Singh Garhwali Uttarakhand University of Horticulture and Forestry, Ranichauri Campus, Tehri-Garhwal (2000 m altitude, 30^0 15'N latitude and 78^0 02'E longitude), the rainfed temperate hills of Uttarakhand during summer-rainy seasons of 2014 and 2015. The experiments were laid out in randomized block design with three treatments involving mulching with black polythene (100µm), white polythene (100µm) and without mulching *i.e.* bared soil. All the treatments were replicated six times in the plots of 4.0m x 1.8 m size. The trials were conducted with PPL-74, the F_1 hybrid of brinjal (*Solanum melongena* L.) developed by Sungro Seeds (India) Pvt. Ltd. The seeds were sown in nursery beds in polyhouse during first week of March and seedlings were transplanted in the main field at 60 x 60 cm spacing on 1.2 m wide raised beds with installed drip system as well as plastic mulches as per requirement of the treatments. The drip laterals passed lying close to the plant basin underneath polythene sheet. The soil of experimental field consisted of pH 6.4, organic matter 5.4% and NPK content of 342.7 kg/ha, 31.8 kg/ha and 544.5 kg/ha, respectively. The field was prepared with deep ploughing, clod breaking and mixing compost @ 15.0 t/ha. Prior to transplanting the field was prepared

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by mixing NPK 80:60:40 kg/ha, respectively in the form of DAP and MoP. The laterals of drip system with online/ flat drippers of 16 mm OD/30 cm/2lph were placed on each row and the system was operates for 45 minutes in each irrigation on alternate day. However, drip system was used up to 15-25 June before onset of the *monsoon*. Later on soil of raised bed resumed sufficient moisture through imbibition of rain water accumulated in furrows between raised beds. The data on soil temperature at 2.0 pm of the day were recorded by inserting thermometer in soil up to 10 cm depth near plant basin in each plot during the month of June, July and August and average soil temperature was worked out for each plot. The data were also recorded for dry biomass of weeds (g /m^2) (Spandl et al. 1999), plant height at first harvest (cm), number of primary branches, days to first harvest (days after transplanting, DAT), number of fruits per plant and fruit yield (q/ha).

The analysed data of two years depicted in tables 1 & 2 revealed that there was significant effect of black and white polythene mulches on soil temperature, dry biomass of weeds, plant growth and fruit yield of brinjal crop in hills. Significantly higher level of mean soil temperature at 10 cm depth was recorded in the plots mulched with white polythene over the years (33.4ºC & 32.8ºC) followed by black polythene (30.6ºC & 28.9ºC). Lowest mean soil temperature was noted in the plots without mulching (24.9ºC & 22.7ºC) which was almost 8ºC and 6ºC lower as compared to that in white polythene and black polythene, respectively. The comparable findings of Duhr and Dubas (1990) also showed an increase of 2.9ºC –3.38ºC in soil temperatures with transparent, photodegradable polythene film mulching. Appreciably high variation in dry biomass of weeds was recorded across the treatments over the years ranging from 4.6 g/m^2 in black polythene mulching to 267.5 g/m^2 in without mulching during first year and 5.9 g/m^2 in black polythene mulching to 234.7 g/m^2 in without mulching during second year. Significantly lower dry biomass of weeds in black polythene mulching was because of non-transmission of sunlight and contrarily, higher dry biomass of weed in white polythene mulching was because of transmission of sunlight across the covering material leading to creation of favourable environment for germination and survival of weeds up to certain extent. From the findings, it was evident that black polythene mulch proved effective for weed suppression. Ossom et al. (2001) also observed significant differences in weed control between mulched and unmulched plots of sweet potato.

The vegetative growth characters *viz*., plant height at first harvest, number of primary branches and days to first harvest were also significantly influenced by mulch materials. Maximum values for plant height at first harvest and number of primary branches were noted in the plots mulched with white polythene *i.e.* 83.5 cm and 6.5, respectively in first year and 79.5 cm and 5.2, respectively in second year; whereas, days to first harvest was minimum in this treatment (40 DAT and 45 DAT in first year and second year, respectively). Similarly, number of fruits per plant and fruit yield were also significantly higher in whit polythene mulching over both the years (25.8 and 446.3 q/ha, respectively in first year and 23.5 and 412.5 q/ha, respectively in second year) followed by black polythene mulching (20.4 and 330.4 q/ha, respectively in first year and 18.3 and 313.8

Table 1: Performance of brinjal hybrid PPL-74 under different plastic mulching in hills during summer-rainy seasons of 2014

Mulching	Mean soil temperature (ºC) at 10 cm depth	Dry biomass of weeds (g/m^2)	Plant height at first harvest (cm)	Number of primary branches	Days to first harvest (DAT)	Number of fruits per plant	Fruit yield (q/ha)
Black Polythene	30.6	4.6	77.6	5.2	45.0	20.4	330.4
White Polythene	33.4	75.06	83.5	6.5	40.0	25.8	446.3
Without mulching	24.9	267.5	56.5	4.5	52.0	8.5	112.2
CV (%)	9.3	16.4	13.2	10.2	8.5	7.5	13.2
CD (0.05)	0.9	75.3	8.6	0.8	4.6	2.6	39.6

Table 2: Performance of brinjal hybrid PPL-74 under different plastic mulching in hills during summer-rainy seasons of 2015

Mulching	Mean soil temperature (ºC) at 10 cm depth	Dry biomass of weeds (g/m^2)	Plant height at first harvest (cm)	Number of primary branches	Days to first harvest (DAT)	Number of fruits per plant	Fruit yield (q/ha)
Black Polythene	28.9	5.9	74.6	4.0	45.0	18.3	313.8
White Polythene	32.8	82.6	79.5	5.2	45.0	23.5	412.5
Without mulching	22.7	234.7	53.8	4.2	50.0	8.9	123.9
CV (%)	11.4	13.2	12.6	8.6	6.0	7.5	16.4
CD (0.05)	1.2	61.8	5.7	0.9	NS	2.6	47.6

q/ha, respectively in second year). Higher mean soil temperature accompanied with better plant growth, early fruiting and higher fruit yield in white polythene mulching was a peculiar finding in this experiment and that was probably because of favourable hydro-thermal regime of soil and low weed competition for nutrient. These findings were in consonance with those of Mahadeen (2014) and Mishra (2017) in squash and Cenobio et al. (2007) and Parmar et al. (2013) in watermelon. In spite of high level of weed suppression in black polythene mulching, fruit yield was noticeably lower as compared to that in white polythene mulching. However, mean soil temperature in black polythene mulching was significantly lower as compared to that in white polythene mulching. It indicated that soil temperature was the main factor for governing the fruit yield in temperate hills particularly in the crops favouring hot climate like brinjal and cucurbits. Drastically lower fruit yield in brinjal crop without mulching (112.2-123.9 q/ha) could be cumulative effect of lower mean soil temperature in rhizosphere (22.4-24.9ºC) and higher weed competition with the crop (234.7-267.5 g/m^2 dry biomass of weeds). On the basis of above results, it could be concluded that application of 100µ thick white polythene as mulch material resulted in 32.8-33.4ºC soil temperature and high level of weed suppression leading to manifold increase in fruit yield in brinjal (412.5-446.3q/ha) as compared to black polythene mulching (313.8-330.4 q/ha) and without mulching (112.2-123.9 q/ha). Therefore, white polythene (100µ) mulching is recommended for brinjal cultivation in temperate hills of western Himalaya during summer-rainy season.

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