



EFFECT OF PLASTIC MULCH COLOUR ON GROWTH AND YIELD OF KALMEGH (*ANDROGRAPHIS PANICULATA* NEES) UNDER TARAI CONDITION OF UTTARAKHAND

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Abstract

Kalmegh is well recognized for its medicinal and pharmacological uses. It is used in different systems of medicine and exhibits anti-malarial, anti-diabetic, anti-pyretic, hepatoprotective, anti-inflammatory and anticancerous properties etc.. The major limiting factor in cultivation of kalmegh is the high infestation of weed which ultimately affects the yield of produce. Present investigation was conducted to check the effect of different colour mulches (*white, black and silver*) on growth and yield of kalmegh (*Andrographis paniculata* Nees). The results revealed that there are significant differences in plant height (cm), number of leaves per plant, number of branches per plant, leaf area per plant and dry matter content per plant (g) using black coloured mulch as compared to control. Thus, application of black colour mulch can be a good floor management option for controlling weed infestation and for obtaining high yield in kalmegh.

Key words: Kalmegh, colour mulch, weed management, yield, growth parameters.

Kalmegh (*Andrographis paniculata* Nees) holds a great value in medicinal world. The plant is popularly known as “king of bitter” due to its characteristic bitter taste (1). It belongs to the family Acanthaceae. Kalmegh is mostly grown in southeast asian countries like Pakistan, Indonesia, Sri Lanka and Malaysia and has been growing long for medicinal purpose in India, Thailand, China, East and West Indies and Mauritius (2-6). The plant possesses anti-bacterial, anti-thrombotic, anti-inflammatory, immunological and hepato protective properties (2). International and domestic demand for Kalmegh is on the rise for treatment of different ailments. Despite this, especially during the Covid 19 pandemic production is unable to meet current demand. Portion of leaves and roots of kalmegh is used to cure cough, cold, fever, diarrhoea, snake bite, cervical erosion, neonatal subcutaneous ulcer, vaginitis, pelvis inflammation and also found useful in HIV and AIDS (7). With all these benefits, it is grown in the kharif season and is an annual crop, reaches upto a height of 50 cm to 1 m. The major problem, encountered in its cultivation, is the heavy weed infestation in the crop which decreases the yield and quality of crop. Mulches are one of the best methods of controlling weeds as chemical weed control is not advocated due to quality concern. Mulches have proven to be effective in stress conditions like in drought stress, freezing injuries also in improvement of

chemical, physical, biological properties of soil, disease control, and enhancing crop yields (8-10). There is wide range of mulches from organic to inorganic. Organic mulches include straw, grasses, wood shavings, cotton gin waste etc. These organic wastes are decomposed easily but labour intensive. On the other hand, plastic mulches possess less of these problems. Plastic mulches come in different colours i.e. black, white, green, red, blue, silver, yellow and transparent with each colour associated with different benefits. So, in order to address the high weed infestation problem in kalmegh, a research trial has been designed on “Effect of plastic mulch colour on growth and yield of kalmegh under *Tarai* condition of Uttarakhand”.

Material and methods

The present study was conducted at Medicinal Plants Research and Development Centre, Govind Ballabh Pant University of Agriculture and Technology, Udham Singh Nagar (Uttarakhand) during kharif season of 2020 and 2021. The experimental site was located at 79.5° E longitude and 29° N latitude with average annual rainfall of 1420 mm. The soil of the experimental area was silty clay loam in texture. The chemical characteristics indicated low availability of nitrogen (210.26 kg ha⁻¹), high availability of phosphorus (27.89 kg ha⁻¹), medium availability of potassium (246 kg ha⁻¹) and high organic carbon (0.87%) contents and almost neutral in reaction (pH 7.2). The gross and net plot sizes were 6.0 m x 4.8 m and 3.6 m x 2.8 m, respectively. The kalmegh variety ‘CIM-Megha’ was sown at 40cm X 30cm spacing on July 10, 2020 and July 12, 2021 and uniform cultural practices were adopted for raising the crop except the variation in mulch treatments.

The experiment consists of four treatments i.e. three coloured mulches along with control (T₁- black, T₂-white, T₃- silver

colour), with five replications applied in randomized complete block design. Different types of mulch were applied at the time of sowing. All the three polyethylene mulches were of 30 micron and transplanting was done by cutting out holes at 40 cm X 30 cm apart. Data was recorded for plant height (cm), number of leaves per plant, number of branches per plant, leaf area per plant and dry matter content per plant (g). For all the parameters data were recorded in 30 days interval i.e. at 30, 60 and 90 days after transplanting (DAT), as the harvesting of crop is done at 90 days. For measuring plant height, meter scale was used and plant height was measured from ground to the tip of the longest leaf. Total number of branches was estimated by counting primary, secondary and tertiary branches of plants. Number of leaves was estimated by simply counting the leaves at the 30 days interval. For measuring the dry weight, plants were sun dried as well as oven dried (70°C) in order to obtain constant weight and then dried weight was recorded using digital weighing balance. In order to measure leaf area, leaf area meter was used. The data recorded were pooled and analyzed for variance as per standard procedure of Randomised Block Design (RBD) using OPSTAT programme developed by the CCSHAU, Hissar. Data were analyzed using the software and the analyzed data were compiled in the tables.

Results and discussion

Plant height

The result presented in the table 1 shows the significant differences with respect to plant height due to mulch treatment. The plant height was recorded maximum in case of black plastic mulch. This must be because of the fact that black plastic mulch is a dark coloured mulch and can increase the temperature just beneath it and also checked the weed infestation due to non-transparent to light and

hence restricted the photosynthesis. Coloured plastic mulch also enhanced plant growth and development by creating optimum growing conditions, such as adequate humidity and temperature in the root zone (11). Additionally, coloured plastic mulching contributed towards a better microclimate around plants, which increased cell growth and elongation as compared to non-mulch condition. Similar findings have been reported, where black plastic mulch resulted in increase in plant height of bell peppers plants (12) and in pickling cucumber (13).

Number of leaves per plant

Number of leaves per plant was found to be increased with black plastic mulch as compared to white and silver colour mulch treatments (Table 1). Adequate weather and soil moisture condition are the essential factors which were affecting this character. Further, reduction in weed population with black plastic mulch allowed more space for spread of plants, less competition for water, nutrient and solar radiation with higher

photosynthetic efficiency which ultimately resulted in higher number of leaves per plant. Similar results were obtained with black plastic mulched chilli (14) and lettuce (15) plants as higher number of leaves were recorded in both following mulching treatment.

Leaf area per plant

The data presented in Table 1 indicated that leaf area per plant had increased with crop growth stage and reaching its maximum at 90 DAT (Table 1). Maximum leaf area per plant was observed in black plastic mulch treatment than all other treatments in all the dates of sample collection. The reason was that weeds were effectively checked by black plastic mulch treatment, resulting in a favourable environment for plant growth, leading to increased leaf area (16). Similar results were reported in case of potato with higher leaf area and plant dry weight after mulch application (17). In cucumber also, when black plastic mulch was applied, leaf area per plant showed the increasing trend (13).

Table 1: Effect of plastic mulch colour on plant height, number of leaves and leaf area per plant in kalmegh

S.No.	Treatment details	Plant height			Number of leaves per plant			Leaf area per plant		
		30DAT	60DAT	90DAT	30DAT	60DAT	90DAT	30DAT	60DAT	90DAT
1.	Control (no mulch)	17.047	32.317	40.910	83.000	192.000	331.667	501.597	684.750	2,004.810
2.	T1- white mulch	27.963	40.553	51.240	77.667	126.667	289.333	541.367	1,892.460	3,461.770
3.	T2-black mulch	35.697	53.903	64.260	108.333	306.333	392.000	862.907	3,963.930	4,641.680
4.	T3- silver mulch	32.900	51.050	58.453	101.000	165.667	362.000	824.883	2,423.490	3,729.177
	C.D.	1.000	1.484	1.209	4.654	N/A	6.643	50.67	120.50	315.75
	SE(m)	0.284	0.421	0.343	1.319	37.198	1.883	16.95	40.33	105.10

Number of branches per plant

The data presented in table-2 with respect to number of branches per plant indicated a significant influence among the treatment values after mulch installation. The treatment T₂ (black mulch) performed better as compared to other treatments in all the reading dates, however, on 30 DAT the treatments T₂ and T₃ had shown significantly at par results for number of branches per plant. At 60 DAT and 90 DAT, the black mulch treatment (T₂) was significantly superior to the other treatments. Due to reduction in weed population and lesser competition for resources with mulch, it allowed more space for spread of plants which ultimately resulted in

increased number of branches per plant. These results are in conformity of the earlier findings reported in chilli (14) and kalmegh (16).

Dry matter accumulation per plant

Maximum dry matter accumulation was recorded with black plastic mulch and lowest was recorded with control (no mulch). The reduction in dry matter accumulation per plant with no mulch is due to weeds as a result of unrestrained conditions for weeds that resulted in nutrient, solar radiation, and space competition among crop plants and weeds. On the other hand, weed population was effectively controlled by black plastic mulch and thus allowing plants to take proper nutrition, sunlight and water. Similar result with increased dry biomass of cucumber with black mulch was also observed (13).

Table 2: Effect of plastic mulch colour on number of branches and dry matter accumulation per plant in kalmegh

S.No.	Treatment details	Number of branches per plant			Dry matter accumulation per plant		
		30DAT	60DAT	90DAT	30DAT	60DAT	90DAT
1.	Control (no mulch)	7.667	20.667	30.667	3.850	13.550	19.960
2.	T ₁ - white mulch	12.667	23.667	35.000	4.577	24.347	38.330
3.	T ₂ -black mulch	17.000	40.000	51.333	5.960	35.750	58.683
4.	T ₃ - silver mulch	14.667	32.333	44.667	5.213	26.297	52.250
	C.D.	3.672	4.059	2.252	1.417	3.200	3.681
	SE(m)	1.041	1.151	0.638	0.402	0.907	1.044

Conclusion

The experimental results have shown that the use of black plastic mulch of 30 micron e had positive impact on growth improvement in kalmegh. All the growth parameters were significantly higher with black plastic mulch treatment then other mulch treatments and control. Improved soil moisture conservation, soil temperature and nutrient availability as a result of reduced leaching of nutrients and reduced weed infestation provided by mulching might have contributed to the better growth and development of kalmegh, however, amongst different plastic mulches, the use of black plastic much was found most effective for improved growth and yield contributing traits in kalmegh and this practice could be recommended to farmers for better production under *Tarai* conditions of Uttarakhand.

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