

Effect of Geo-Textile Mulch on Soil Moisture, Temperature and Yield of Vegetable Crops Grown in Alluvial Plains of Bihar

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ABSTRACT

The study was conducted to know the effect of geo-textile mulch on the growth, yield of vegetables (Pointed gourd and Capsicum) and to find out effect of different thickness mulch on soil temperature and moisture under alluvium soils of Bihar plains. Both geo-textile mulch and straw mulch are effective in checking heat and moisture loss from soil. Geo-textile materials of 200 to 300gsm thickness are more effective in moisture and heat conservation in cultivation of vegetable crops. Extensive root growth was also observed with the application of 300gsm geo-textile mulches. Performance of rice straw was on par with expensive geo-textile materials in respect of heat and moisture conservation and enhancement of yield.

Key words: Geo-textiles, Pointed gourd, Capsicum, Soil moisture, root growth.

INTRODUCTION

Mulch is defined as "an application or creation of any soil cover that contributes a barrier to the exchange of heat or vapor" (Rosenberg 1974). Geo-textiles as a media for soil reinforcement have been known from early civilizations, can be effectively used enabling speedy growth of vegetation. Geo-textiles are any textile like material, either woven, non-woven, or extruded, used in civil engineering applications to improve soil structural performance.

Being biodegradable and eco friendly it is an excellent substitute for geo-synthetics. It provides an excellent microclimate for plant establishment, natural invasion and balanced healthy growth (Sudhakaran P.M., 2003). The main functions geo-textiles provide are aggregate separation, soil reinforcement and stabilization, filtration, drainage, and moisture or liquid barriers (Dewey 1993).

Historically, the effectiveness of mulches on seedling survival has varied widely. Soil conditions, light, and the longevity of the mat contribute to this. In especially adverse

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conditions, survival has increased from near 0% to over 90%. In more typical situations, survival increases from 40% to 60% (Brent English, 1995).

The study was started in order to know the effect of geo-textile mulch on the growth and yield of vegetables and to find out effect of different thickness mulch on soil temperature and moisture.

MATERIALS AND METHODS

Four thickness of geo-textile (150,200,250 and 300gsm) mulch, straw mulch and a control were taken as treatments in four replications. Pointed gourd and capsicum were taken as test crops in silty clay loam soil. 10x10 m plots were taken in Randomized Block Design (RBD). Swarna Aloukik variety of pointed guard and California wonder variety of capsicum respectively were grown for our study. The mulch materials of different thickness were spread over on the soil after making plot leveling. The saplings/cuttings were planted according to the recommended spacing by making cuts on the mulch at already demarcated /made pits in the soil. Soil moisture was recorded at regular intervals throughout season of the crop with help of TDR meter at different depths and oven dry method. Soil temperature was recorded at regular intervals with the help of soil thermometers at 0-5 cm and 5-10 cm depth.

RESULTS AND DISCUSSION

Soil Temperature Variation

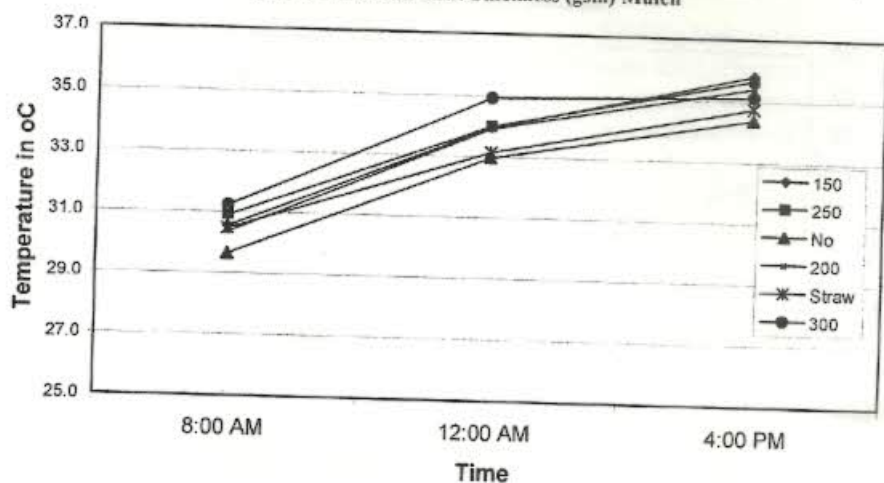
Jute mesh typically covers 35-40% of the soil surface, providing shade, insulation against temperature extremes, and maintenance of humidity, whilst not inhibiting plant growth. This enables the sapling to make full use of light, moisture, and nutrients. The mulch also acts as a soil insulator and as a vapor block. As a soil insulator, the mulch helps keep the soil warm in the early and late part of the growing season. As a vapor barrier, the mulch acts to suppress evaporation. (Brent English, 1995).

It is observed that, in case of pointed gourd, at 8.00AM when ambient temperature was low, the mulched plots showed more soil temperature than no mulch or control plots. Same trend was observed throughout the day. Initially, the temperature in the 150,200 and 250gsm geo-textile mulched plots was almost at par, whereas higher soil temperature was observed in 300gsm geo-textile materials during noon compared to the other thickness mulches. However, there was not much variation was seen in the evening hours (Fig. 1).

Soil Moisture Variation

Jute is able to absorb up to five times its own weight in water, which lessens initial run-off, and provides a moisture reserve for plant growth. It was observed that mulched plots conserved more moisture than control or no mulch plot, in case of pointed gourd. Highest moisture (%) was recorded in case of 300 gsm thick geo-textile plots followed by 250gsm thick geo-textile plots. Straw and 200gsm thick geo-textile plots showed similar results in respect of moisture conservation. Interesting results were observed in case of capsicum

Fig. 1: Variation in Average Temperature at (Pointed Ground) 5-10 cm. of Soil under Different Thickness (gsm) Mulch



plots, where straw mulch was found to conserve more moisture followed by 300 gsm, 150 gsm, 200gsm and 250 gsm thick and no mulch geo-textile mulched plots (Fig. 2 & 3).

Root growth: The root growth studies in pointed gourd indicated that with increase in thickness of the geo textile mulch the root growth improved. Most of the root characteristics improved under the geo-textile mulch compared to control. The highest growth was observed in 300-gsm mulch followed by 250 gsm. However, it is at par with root growth under straw mulch (Fig. 4).

Fig. 2: Variation in Moisture (%) in Pointed Gourd Plots (0-15 cm.) under Different Treatments

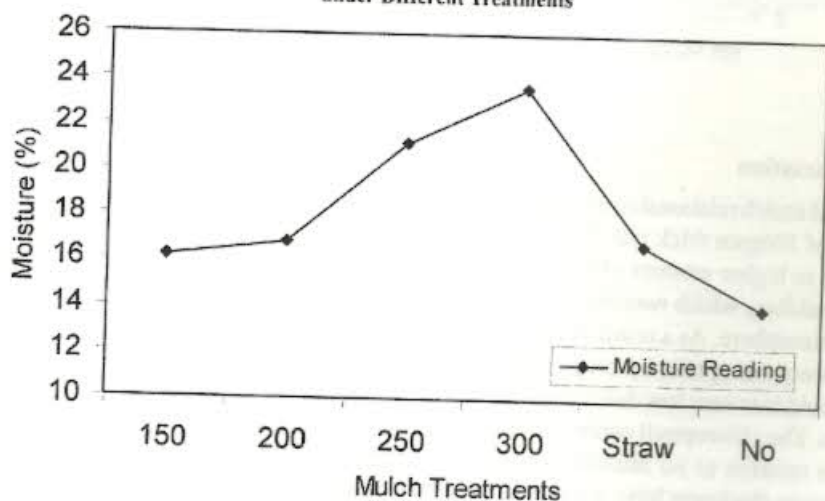


Fig. 3: Variation in Soil Moisture at 0-15 cm in Capsicum under Thickness Geo-textile Mulch

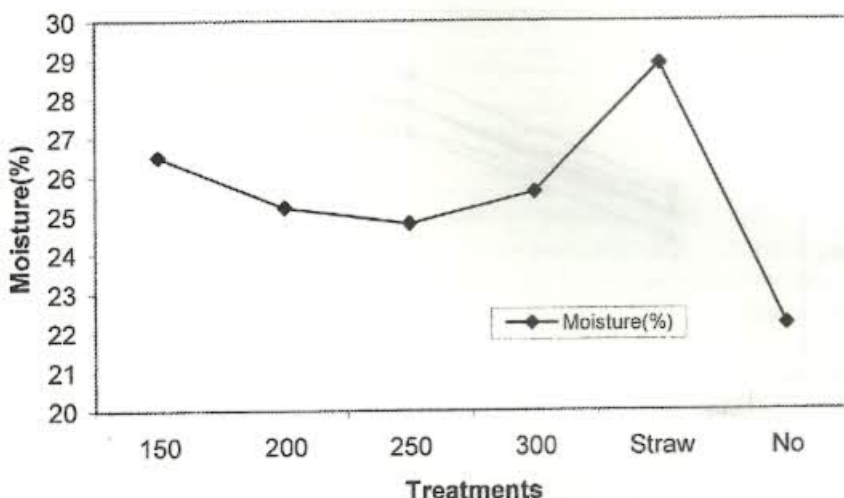
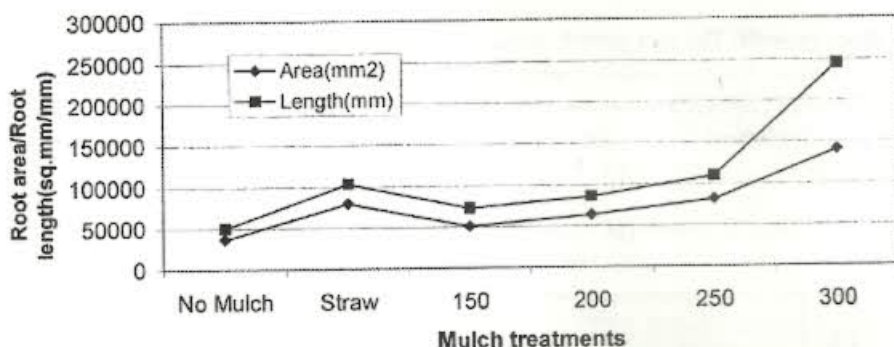


Fig. 4: Root Growth of Pointed Gourd under Geo-textile Mulch



Yield Variation

Yield and mulch relationship in case of capsicum revealed that, highest yield was observed in case of 300gsm thick plot followed by 250 gsm thick and straw mulched plots. This was due to higher amount of heat and moisture conservation by 300gsm, 250 gsm and straw mulches; which resulted in better root growth and enhanced microbial activities in the rhizosphere. As a result availability of nutrients to the crops through mineralisation and subsequent uptake by crops might have increased. In case of control or no mulch plots, yield was very low due to higher evaporation of soil moisture and less proliferation of roots. The chlorophyll content index recorded was highest (47.3) in 300gsm-mulched plots in relation to no mulched (20.0) plots. Thus, it is established that, mulches of appropriate thickness have a significant positive correlation with yield of crops.

CONCLUSIONS

Both geo-textile mulch and straw mulch are effective in checking heat and moisture loss from soil. Geo-textile materials of 200 to 300gsm thickness are more effective in moisture and heat conservation in cultivation of vegetable crops. Congenial environment in the rhizosphere is created for enhanced microbial activities towards increased availability of nutrients to plants. Extensive root growth was also observed with the application of 300gsm geo-textile mulches. Performance of rice straw was found to be as per with expensive geo-textile materials in respect of heat and moisture conservation and enhancement of yield.

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REFERENCES

- Brent English (1995), Geotextiles-A Specific Application of Biofibers. In: Olesen, Ole; Rexen, Finn; Larsen, Jorgen, eds. Research in Industrial Application of Non Food Crops, I: Plant Fibres: Proceedings of a Seminar; 1995 May; Copenhagen, Denmark. Lyngby, Denmark Academy of Technical Sciences: 79-86.
- Dewey, C.S. (1993), Use of Geo-textiles on Federal Land Highway projects. Engineering field Notes, Volume 26, May-June, pp. 17-22.
- Footpaths, BTCV Handbooks Online.html.
- Sudhakaran Pillai M. (2003), Eco-friendly Practices/remedial Measures for Environmental Sustainability. In 4th International R&D Conference on Water and Energy for 21st Century, 28-31, January 2003 Aurangabad, Maharashtra, India.
- Rosenberg, N.J. (1974), Microclimate: The Biological Environment, New York, Wiley Inter Science, pp. 150-157.