Biosc.Biotech.Res.Comm. Special Issue Vol 13 No 12 (2020) Pp-15-18

BBRC
Bioscience Biotechnology Research Communications

An Overview of Geotextiles in Agriculture

Arunabha Pal[1*], Rahul Adhikary[1], Monishankar Bera[1], Rohit Garanayak[1], Gaikwad DJ[2] and Susanta Kumar De[3]

[1]*Assistant Professor, Department of Agricultural Chemistry and Soil Science*
[2]*Department of Plant Physiology, Centurion University of Technology and Management, Odisha, India*
[3]*Professor, Department of Soil and Water Conservation, BCKV, W.B*

ABSTRACT

Geotextiles are lightly fabric made from jute, coco coir or any natural plant fbers. Geotextiles a natural product are eco-friendly and biodegradable in nature and act as useful ameliorative to eliminate the soil related constrains of crop production. Bio deterioration of cellulose fiber results from the reduction at die polymerization leading to loss textile strength. It also helps to protect the most vital natural resources of soil and water from various degradation processes by erosion of soil and runoff water. It plays a vital role in increasing moisture holding capacity in soil, improving water uptake and drainage capacity. Application of suitable ameliorative thus necessitates for improving various soil conditions towards increasing the crop productivity.

KEY WORDS: GEOTEXTILE, SOIL PROPERTIES, MULCHING AND SOIL EROSION.

INTRODUCTION

Geotextile is totally biodegradable, geotextiles will stabilise the soil along with fostering its fertility. Apart from protecting the soil, the sheets will eventually turn into organic manure, making the soil more nutrient rich. While allowing water to pass through and blocking rapid moisture evaporation, the porous fabric will also protect the soil surface. In the first phase of the project, tubers, including yam, taro, purple yam and tapioca, will be planted along with curry leaves. Naturally occurring jute agro geo-textiles are eco-friendly and biodegradable products which act as surface cover materials and useful ameliorative to eliminate soil related constraints to crop production (Yong et al.,2000; Pain et al., 2013, Pal et al., 2020). It also helps to protect the most vital natural resources against various degradation processes and promotes vegetative cover it through accelerated seed germination and seedling emergence (Bhattacharya et al., 2010).

Natural geotextiles degrades to form organic mulch and held in weak establishment of vegetation. Jute geotextile degrades in 1 to 2 years, dry grasses, coco coir geotextile and Banana leaf fiber, geotextile degrades 1 to 2 to 3 years (Adhikary et al., 2019 Adhikary et al., 2016 and Pal et al., 2020). The use of different types of geotextiles management practices involving organic resources and shows beneficial effect on improving soil fertility, mentioned soil health and sustainable crop production scientific information's in relation to the above are reviewed hear under. Application of geotextiles is location specific so in addition to the characteristics of geotextiles, identification and application of geotextiles depends on soil type, soil compaction, moisture content, liquid limits, plasticity index, bulk density, soil pH, iron/ calcium content, clay / silt and sand composition, land sloping and hydraulic action etc. (Adhikary et al., 2019 and Pal et al., 2019).

ARTICLE INFORMATION

Corresponding author email: arunabha@cutm.ac.in
Received 9th Oct 2020 Accepted after revision 27th Dec 2020
Print ISSN: 0974-6455 Online ISSN: 2321-4007 CODEN: BBRCBA

Thomson Reuters ISI Web of Science Clarivate Analytics USA and Crossref Indexed Journal

NAAS Journal Score 2020 (4.31) SJIF: 2020 (7.728)

Online Contents Available at: http//www.bbrc.in/

Geotextile in Agriculture: Eco geotextile another similar soil conditioner, are equally effective in erosion control, stabilization of soil slops and increasing water retention capacity also improve crop productivity (Rajgopal and Ramkrishna, 1997). Ahmed (1993) reported that influence of composted coconut coirdust (coirpith) on soil physical properties, growth and yield of tomato. In a field trial with tomato cv. Pusa Ruby on an Alfisol soil, composted coir pith (5-20 t/ha). Improved soil condition and bulk density) and moisture retention capacity compared with 10 t FYM/ha. Fruit yields were greatest (19.01 t/ha) with FYM, followed by 20 t coir pith/ha (16.97 t fruit/ha) and were lowest in controls (11.23 t/ha), which were treated with neither FYM nor coir pith. Hongal et al., (2010) reported that effect of green manures and nitrogen levels on the soil properties. In the field experiment conducted effect of green manures and nitrogen levels in cotton + chilli cropping system was evaluated. Sun hemp recorded higher phyto mass (25.58 ton/ha) followed by cowpea (22.44 ton/ha) and green gram (14.40 ton/ha). Similar trend was observed in biomass production and Accumulation.

Effect of geotextile in soil properties: Sinowski and Auerswald (1992) Studied that fleece used as a geotextile maintained its water holding properties and varied its speed of wetting after each application. The erosion protection of the tested geotextiles was increased by 30%, depending on the effect of covering. Soil infiltration was improved more with geotextiles than with fallowing. Andre and Gerand (1988) reported that geotextiles made from synthetic fibres are used in drainage applications. This function can be assumed for many years if no alteration or changes of their structure results from chemical attack, mechanical deterioration, mineral and bacterial clogging and accumulation of particles, or organic matter between or upstream of the fibres. Thomas et al., (1987) reported that the geotextiles have been employed to reduce lateral deformation of bridge approach embankments and to prevent closure of the expansion devices in the bridges.

This concept will be implemented in an existing bridge undergoing reconstruction. Chen et al., (2009) reported that the water absorption characteristics of geotextile can influence runoff producing process directly, and their decomposition characteristics relate to the geotextile durability for soil and water conservation. Olesen et al., (1995) reported that geotextiles are any textile like material used to enhance soil structural performance. Biobased geotextiles are used for short term (6 months to 10 year) applications where biodegradability is a positive attribute, such as mulching and erosion control. Biswas et al., (1970) reported that the nature of organic matter played an important role in the development soil structure owing to diferential nature of by products produced during the process of decomposition. Rajagopal and Ramakrishna, (1997) describe properly about to improve the soil organic carbon (SOC) and soil by the application of geotextile.

Effect of geotextile on soil erosion control: Smets et al., (2007) conducted a field experiment on palm-leaf geotextiles could be an effective and cheap soil conservation method with enormous global potential. Effectiveness of palm geotextiles reducing soil erosion from water. A field experiment was conducted by Paterson and Barnard (2011) in South Africa Beneficial effect of palm geotextiles on inter-rill erosion. Geotextile mats made of woven palm leaves showed potential using a rainfall simulator for their effectiveness in reducing surface runoff and sediment load from a range of South African soils and mine tailings. Rickson (2000) has done another experiment on geotextiles and reported that geotextiles can be used to control soil erosion and establish vegetation on disturbed landscapes or newly constructed sites. Rickson (2006) reported the controlling sediment at source an evaluation of erosion control geotextiles. This paper presents one method to evaluate the effectiveness or ability of geotextiles in controlling soil erosion. Smets et al., (2009) conducted a field experiment that impacts of soil tilt on the effectiveness of biological geotextiles in reducing runoff and in Terrill erosion. Bhattacharyya et al., (2010) reported that use of palm-mat geotextiles for rain splash erosion control. Hence, the utilization of palm-mat geotextiles as a rain splash erosion control technique was investigated at Hilton.

Effect of geotextile as mulch: Nag et al., (2008) reported that mulch is a layer of material spread on top of the soil to conserve soil moisture, discourage the growth of weeds, help prevent erosion and prevent large fluctuations in soil temperature. Kaku et al., (2007) reported that Geotextile mulch had become popular recently in the installation of landscape ground cover, because it provides both suppression of weeds and maintenance of soil conditions desirable for cover-plant growth. Effect of mulching of plant materials on the growth of ground cover plants and emergence of weeds on levee slope. Otani et al., (2009) reported that ground cover plants are useful for weed suppression on levee slopes. However, weeding is necessary until the slopes has covered with ground cover plants. Walsh et al., (1996) reported that the effects of cultivation, straw mulch, geotextile mulch, grass cover, a cover crop mixture of lupin (Lupinus albus) and wild carrot. Wilen et al., (1999) reported that Weed control efficacy of organic mulches as well as a copper hydroxide-coated geotextile (fabric) disk was examined using Rhaphiolepis indica cultivars Snow White and Pinky or Callistemon citrinus growing in containers.

CONCLUSION

Geotextiles of various natures due to its effects as surface cover materials have potentials for maintaining soil quality and protecting the soil against any form of degradation. Each of the geotextiles increased the higher yield associated with much increase of organic carbon and availability of phosphorous and potassium. Sharp improvements of bulk density, porosity, moisture

use efficiency as well as better aggregation and well stabilization of soil aggregates occurred due to application of each geotextiles, of which jute geotextile showed most prominent effect in all such respect.

REFERENCES

Adhikary R and Pal A (2019). Geotextile and its Importance in Agriculture: A Review Study. International Journal of Bioresource Science. 6(2): 61-63.

Adhikary N, Disha A, Mahata AP, Pal A, Adhikary R, Sardar M, Saha A, Bauri SK, Tarafdar PK and De SK (2016). Efficient use of jute agro textiles as soil conditioner to increase chilli productivity on Inceptisol of West Bengal. Journal of Soil and Water Conservation. 15(3): 242-245.

Andre, L. and Gerard, L. (1988). Mechanisms affecting long-term filtration behavior of geotextiles. Geotextiles and Geomembranes. 7(1-2): 119-145.

Ahmed, S.R. (1993). Influence of composted coconut coirdust (coirpith) on soil physical properties, growth and yield of tomato. South Indian Horticulture. 41(5): 264-269.

Biswas, T.D., Roy, M.R. and Sahu, B.N. (1970). Effect of different sources of organic manure on the physical properties of the soil growing rice. Journal of the India Society of Soil Science. 18: 223 – 242.

Bhattacharyya, R., Smets, T., Fullen, M.A., Poesen, J. and Booth, C.A. (2010). Effectiveness of geotextiles in reducing runoff and soil loss: a synthesis. Catena. 81(3): 184-195.

Chen, X., YongMei, L. and Zheng, Y. (2009). Research on water absorption characteristic and decomposition velocity of rice straw, jute fibre and palm leaf. Journal of Yunnan Agricultural University. 24(2):260-264.

Hongal, M.M., Chittapur, B.M., Hiremath, S.M., Koti, R.V. and Hosamani, R.M. (2010). Effect of green manures and nitrogen levels on the soil properties. Environment and Ecology. 28(1A): 251-254.

Kaku, T., Ito, M. and Ito, K. (2007). Weed management issues and dynamics during establishment of phlox (Phlox subulata L.) ground cover using geotextile mulch. Journal of Weed Science and Technology. 52(2): 57-65.

Nag, D., Choudhury, T.K., Debnath, S., Ganguly, P.K. and Ghosh, S.K. 2008. Efcient management of soil moisture with jute non-woven as mulch for cultivation of sweet lime and turmeric in red lateritic zone, Journal of Agricultural Engineering, New Delhi, 45(3): 59-62.

Olesen, O., Rexen, F. and Larsen, J. (1995). Research in industrial application of nonfood crops, I: plant fibres. Seminar of Denmark Academy of Technical Sciences. pp. 79-86.

Otani, I., Watanabe, O. and Fushimi, A. (2009). Effect of mulching of plant materials on the growth of ground cover plants and emergence of weeds on levee slope. Journal of Weed Science and Technology. 54(3): 129.

Pine D, De SK, Tarafadar PK, Pal Arunabha, Mahata AP, Adhikary R and Bauri SK (2013). Efficient use of geotextiles as soil conditioner to increase potato productivity on inceptisol of West Bengal. Journal of Soil and Water Conservation. 12(2):104-107.

Pal Arunabha, Adhikary R, Bear M, De SK and Sardar M (2020). Application of Different Geotextile in Soil to Improve the Soil Health in Humid and Hot Sub Humid Region of West Bengal, India. International Journal of Current Microbiology and Applied Sciences. 9(6): 2812-2818.

Pal Arunabha, Adhikary R, De SK and Sardar M (2020). Effect of different geotextile treatments in soil to increase the yield and yield attribute of capsicum (*Capsicum annuum*). International Journal of Chemical Studies. 8(3): 2620-2622.

Pal Arunabha, Adhikary R, Barman S and Maitra S (2020). Nitrogen transformation and losses in soil: A costeffective review study for farmer. International Journal of Chemical Studies. 8(3): 2623-2626.

Pal Arunabha, Adhikary R, Bera M and Garanayak R (2019). To Study About Yield and Yield Attribute Parameter on Tube Rose by Application of Different Irrigation Treatments in West Bengal. International Journal of Bioresource Science. 6(2): 51-55.

Pal Arunabha, Adhikary R, Bera M, Garanayak R and Roy R (2019). Growing of tube rose with different irrigation treatment under alluvial soil of West Bengal. Journal of Pharmacognosy and Phytochemistry. 98(3): 4534-4538.

Paterson, D.G. and Barnard, R.O. (2011). Beneficial effect of palm geotextiles on interrill erosion in South African soils: field trials. South African Journal of Plant and Soil. 28(3): 190-197.

Rajgopal, K. and Ramkrishna, S. (1997). Degradation behavior of coco geotextiles with in clay soils. Proceedings of the Asian Regional Conference on Geosynthesis. pp. 25-29.

Rickson, R.J. (2000). The use of geotextiles for vegetation management. Aspects of Applied Biology. 58: 107-114.

Rickson, R.J. (2006). Controlling sediment at source: an evaluation of erosion control geotextiles. Earth Surface Processes and Landforms. 31(5): 550-560.

Sinowski, W. and Auerswald, K. (1992). Erosion protection of road embankments and steep slopes with biologically degradable geotextiles. Mitteilungen der Deutschen Bodenkundlichen Gesellschaft. (68): 181-184.

Smets, T., Poesen. J., Fullen, M.A. and Booth, C.A.

(2007). Effectiveness of palm and simulated geotextiles in reducing run-off and inter-rill erosion on medium and steep slopes. Journal of Soil Use and Management. 23(3): 306-316.

Smets, T. and Poesen, J. (2009). Impacts of soil tilt on the effectiveness of biological geotextiles in reducing runoff and in Terrill erosion. Soil and Tillage Research. 103(2): 356-363.

Thomas, V., Edgar, J., Puckett. A. and William, F. (1987). Utilizing geotextiles in high way bridge approach embankments. Geotextiles and Geomembranes. 5(1): 3-16.

Walsh, B.D., MacKenzie, A.F. and Buszard, D.J. (1996). Soil nitrate levels as influenced by apple orchard floor management systems. Canadian Journal of Soil Science. 76(3): 343-349.

Wilen, C.A., Schuch, U.K. and Elmore, C.L. (1999). Mulches and subirrigation control weeds in container production. Journal of Environmental Horticulture. 17(4): 174-180.