

APPLICATION OF TEXTILE IN AGRICULTURE

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ABSTRACT

Now a day's Textile products are playing very vital role in agriculture for climatic condition and production point of view. Agricultural textiles for its excellent environmental resistance, mechanical properties, easy Processability and environmental durability characteristics, can improve the quantity and quality and safety of agricultural products, agriculture, resource security, agro-ecological environmental security, the market competitiveness of products play an important role, as well as the textile industry to achieve structural adjustment of the special priority to the development of products.

Agro textiles prevent the soil from drying out thereby increasing the crop yield, and improving product quality. Such textiles protect the farmer from harmful pesticides. Agro textile products like shade netting and thermal screens enable a saving of 40% on energy used for heating greenhouses. Farmers have also found that use of agro textiles brings about improvement in the quality of fruit, uniformity of color and prevent staining. As we are not using pesticides and herbicides, pollution in environment will be negligible.

KEYWORDS: - Agriculture, Application, Agro-Textile, Crop, Properties,

I INTRODUCTION

1.1 AGRO –TEXTILE

Textiles used in Agriculture are termed as AGRO-TEXTILES. Agriculture is the backbone of our country" went the saying so far. But do you know that textile can be the backbone of agriculture? The word "AGRO-TEXTILES" is now used to classify the woven, non-woven and knitted fabrics applied for agricultural and horticultural uses. The reduced usage of harmful pesticides and herbicides render a healthy farming culture and is an eco-friendly technique. Agro-textile is an very much important segment of Technical Textile. Agricultural textiles for its excellent environmental resistance, mechanical properties, easy process ability and durability characteristics can improve quantity, quality and safety of agricultural products. Agro processing sector has experienced expansion during last 5 decades, starting with a handful of facilities which were mainly operating at domestic/cottage level.

Agro textiles are application of textile materials in the agriculture field. With the continuous increase in population worldwide, stress on agricultural crops has increased. So it is necessary to increase the yield and quality of agro-products. But it is not possible to meet fully with the traditionally adopted ways of using pesticides and herbicides. Today, agriculture and horticulture has realized the need of tomorrow and opting for

various technologies to get higher overall yield, quality and tasty agro-products. Agro processing is defined as set of techno-economic activities, applied to all the produces, originating from agricultural farm, livestock, aquacultural sources and forests for their conservation, handling and value addition to make them usable as food, feed, fibre, fuel or industrial raw materials.

II ADVANTAGES OF TEXTILES USED IN AGRICULTURE

- Increase Crop Production.
- Avoid The Soil From Drying Out.
- Decrease The Requirement Of Fertilizers, Pesticides And Water.
- They Make Product Quality Better.
- Increase The Early Maturing Of Crops And Non-Seasonal Plants
- Protects from climatic changes and its effect

III RAW MATERIAL USED FOR MANUFACTURING OF AGRO-TEXTILE PRODUCTS

The most important requirements of textiles for agricultural applications are weather resistance and resistance to micro-organisms. Therefore, synthetic fibres are the choice of material for designing of agro-textile products. Synthetic fibres like polyethylene, polypropylene, polyester, nylon are widely used. Synthetic polymers in different forms like tape yarn, monofilament yarn and multi-filament yarn are commonly in use for manufacturing sun screen, bird net, wind shield, hail protection net, harvesting net, etc. Polypropylene polymer is extensively used for the manufacturing of spun-bonded nonwoven for plant growing applications. High density/low density polyethylene sheets are also used for the manufacturing of mulch mats.

Natural fibres like wool, jute, cotton are also used where the bio-degradability of the product is essential. Wool fibres, in needle punched nonwoven form is used for the manufacturing of mulch mats. Jute is extensively used as packing material for agro products. Natural polymer gives the advantage of bio-degrading but has low service life compared to the synthetics.

IV DIFFERENT METHOD OF AGRO-TEXTILE PRODUCTION

The following methods are adopted to manufacture the Agro -textile products

4.1 Weaving and woven products

Woven products are manufactured by using weaving machines especially Sulzer projectile weaving machines. The range of light to heavy and wide width fabric production is possible with Sulzer projectile weaving machine. The machines with weaving width of 540 cm to 846 cm are available for the production of agro-textiles. The nets with a mesh width of 1.8 mm to 40 mm can be produced. Other methods of fabric manufacturing such as air-jet and rapier weaving machines are not preferred for the manufacture of such fabrics as they do not have required weaving width. Shown in Fig 1.

4.2 Knitting

Warp knitting technique is most widely used in comparison to weft knitting. Warp knitted protective nets are used in different sectors, which are produced on Raschel machines. Agronets are produced in various constructions. Shown in Fig 2.



Fig 1.



Fig2.

4.3 Nonwovens

Nonwoven fabrics can be manufactured by various techniques such as:-



Fig 3.

4.4 Needle Punching,

4.5 Spun Bonding,

4.6 Thermal Bonding,

4.7 Spun lacing, Etc.

4.8 Spun bonding and needle punching techniques are widely used for the production of nonwoven agro textiles.

V APPLICATION OF AGRO-TEXTILE

- Agro-Textiles for Crop Production.
- Agro-Textiles for Horticulture.
- Agro-Textiles for Animal Husbandry.

5.1 AGRO TEXTILES FOR PRODUCTION OF CROP

The selection of Agro-textile product is depends on crop needs. Selection of the agro textiles is also greatly influenced by the geographical location. Some of the applications of agro textiles are as follows:

- a) **Sunscreen:** These are used in order to protect fields and greenhouses from the intense solar radiation for healthy plant growth and good harvest. Sunscreen nets with open mesh construction are used to control sunshine and amount of shade required. These net fabrics allow the air to flow freely. So the excess heat does not built up under the screen. Shown in Fig 4.
- b) **Bird protection nets:** Knitted monofilament nets (Open knitted nets for crop protection) offer effective passive protection of seeds, crops and fruit against damage caused by birds and a variety of pests. Open-mesh net fabrics are used as a means of protecting fruit plantation. The special open structure repels birds, provides minimal shading and excellent air circulation - allowing plants to flourish, whilst avoiding the risk of dangerous mold developing on the fruit. Shown in Fig 5.



Fig 4



Fig 5

- c) **Plant net:** Fruits, which grow close to the ground, can be kept away from the damp soil by allowing them to grow through vertical or tiered nets in order to keep the amount of decayed fruit to a minimum. Shown in Fig 6.
- d) **Ground cover:** Ground cover is an extremely versatile landscaping and horticultural fabric for long-term weed control, moisture conservation and separation. It is mainly used in planted areas. It effectively suppresses competitive weed growth, conserves ground moisture, maintains a clean surface, protects from UV rays and creates a favorable environment for healthy plant growth. Ground covers can reduce the costs and minimizes undesirable herbicide use. Using this ground cover in display areas, nurseries and greenhouses will provide a clean, free draining and hard wearing surface. Fabric is regularly used to maintain a clean crop and reduce maintenance and disease problems. Shown in Fig 7.

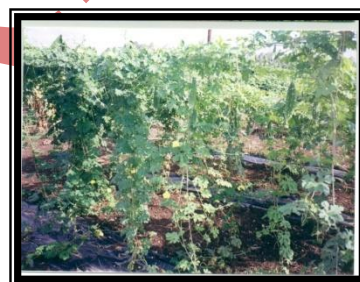


Fig 6



Fig 7

- e) **Windshield:** Windshields are used in farming to protect fruit plantations from wind and to prevent damage to plants. It also prevents plants being cooled by wind too.
- f) **Root ball net:** It is extremely important for safe and speedy growing of young plants such that root system is not damaged when they are dug up, transported or replanted. Normally the root balls are wrapped in cloth. Elastic net tubes are alternative to this. When the plants are transplanted, the nets on the outside do not have to be removed since the roots can protrude through the nets.
- g) **Insect meshes:** Clearly, woven and knitted polyethylene monofilament meshes to exclude harmful insects from greenhouses and tunnels, or to keep pollinating insects inside, The fine woven screens protect plants from insect attack (without the use of insecticides). Shown in Fig 8.
- h) **Mulch mat:** Mulch mats are used to suppress weed growth in horticulture applications, It covers the soil, blocking of light and preventing the competitive wheat growth around seed links, This also reduces the need for herbicides required for weed control Needle punched nonwoven and black plastic sheet are used for this application, Bio degradable and non-biodegradable types of mulch mats are available. Shown in Fig 9.

**Fig 8****Fig 9**

- i) **Monofil nets:** Tough, knitted Monofil, nets for windbreak fences and shading/privacy screens, A suitable windbreak, set at a right-angle to the prevailing wind, will protect plants against the harmful effects of blustery weather - which can break young branches, damage flowers and cause leaves to dry or tear. The nets also protect against frosts and help enhance the micro-climate. This not only safeguards the current harvest but also benefits future crops, since the woody part of the plant are protected too. Shown in Fig10.

**Fig 10**

j) Cold and frost control fabrics: Cold and frost fabric can be laid directly on the plants, unlike plastic covers that can attract frost, and burn any leaf that touches them. These fabrics protect the plant from frost kill during unexpected late cold snaps and unexpected early ones.

k) Nets for covering pallets: For safe transportation of fruits and vegetables to the market the boxes are covered with large mesh nets and pallets to stop the boxes being turned upside down. This prevents damage of goods during transportation

l) Packing materials for agricultural products: Nets can be used for packaging of farm products for many end uses. It includes packing sacks for vegetables, tubular packing nets for fruits and wrappers for Christmas trees, Net structures are preferred because of their high strength, low weight, air permeability and cheapness.

VI AGRO-TEXTILES FOR HORTICULTURE & FLORICULTURE

Application of textile materials in horticulture is growing fast. Nets, non-woven mats, movable screens for glass/poly houses, non-woven sheets, mixed bed for mushrooms, cordage and strings are used in horticulture. Nets are also used for protection against hailstorms, intense sunrays, etc. Non-woven sheets are used in the field to protect young plants such as strawberries, potatoes and lettuce from extreme cold weather, night frost and viruses.



Fig 11

VII AGRO-TEXTILES FOR ANIMAL HUSBANDRY

Nylon and polyester identification belts are used for cows. Textile nets are used to support the large udders. Nonwoven fabrics are used to filter the milk in automatic milking systems and as an underlay to reduce mud on cattle paths and trails.

VIII PROPERTIES REQUIRED FOR AGRO-TEXTILE PRODUCTS

The essential properties required for agro-textile are

- Tensile strength,
- Resistance to solar radiation,
- Resistance to ultraviolet radiation
- Abrasion Resistance
- stiffness, and bio-degradation,

- Resistance to toxic environment.

8.1 TENSILE STRENGTH:

The tensile strength of shade nets can be a deciding factor of its long term durability and service life. Hence good tensile strength is necessary parameter for shade nets.

8.2 RESISTANCE TO SOLAR-RADIATION:

The energy from the sun is transmitted through the shade net to the plant, which is then used in photosynthetic processes. The intensity of photo synthetically active radiations directly influences plant growth. Agro-textiles are laid over the cultivated areas immediately after sowing or planting. For such application, agro textiles have to withstand solar radiation with varying surrounding temperatures. Shown in Fig12.

8.3 RESISTANCE TO ULTRAVIOLET RADIATION:

The Non visible radiations include ultraviolet radiations (UV) radiation leads to degradation of molecular chains. No single material is resistant to all radiations .polypropylene and polyester are more resistant to UV radiations when used as an outdoor material, polyethylene is treated with the appropriate UV stabilizers. Potential to reduce the impact of UV radiation on plants by light absorbing or light-reflecting nonwoven (light permeability: 80 to 90% to allow photosynthesis to take place). Shown in Fig13.



Fig 12



Fig 13

8.4 ABRASION RESISTANCE:

The abrasion to which a shade net is subjected may be of the material itself (material to material) or stray animals .abrasion of the shade net would result in holes through which animals and pests could enter the structure and harm the crops .good abrasion resistance is required of shade nets.

8.5 BIODEGRADABILITY:

Natural fibers like wool, jute, and cotton are also used where the biodegradability of product is essential. Natural polymer gives the advantage of biodegradation but has low service life when compared to the synthetics. Shown in Fig14.

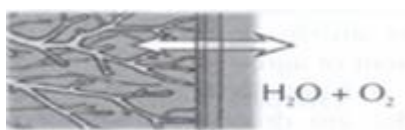


Fig 14

High potential to retain water: This is achieved by means of fiber materials, which allow taking in much water and by filling in super-absorbers while nonwovens. $H_2O + O_2$

Meant for the covering of plants show a mass per unit area of 15 to 60 gm/m², values between 100 and 500 g/m² are reached with materials for use on embankments and slopes.

IX PROTECTION PROPERTY

Protection from wind and creation of a micro-climate between the ground and the nonwoven, which results in temperature and humidity being balanced out. At the same time, temperatures in the root area rise. This is what causes earlier harvests, sufficient stiffness, flexibility, evenness, elasticity, biodegradability, dimensional stability and resistance to wetness. Fungicidal finish (up to 2% of the total mass), which avoids soil contamination.

Agro textiles prevent the soil from drying out thereby increasing the crop yield, and improving product quality. Such textiles protect the farmer from harmful pesticides. Agro textile products like shade netting and thermal screens enable a saving of 40% on energy used for heating greenhouses. Farmers have also found that use of agro textiles brings about improvement in the quality of fruit, uniformity of color and prevent staining. As we are not using pesticides and herbicides, pollution in environment will be negligible.

Table 1

KNITTED NETS						
SHADING	✓	✓	✓			
BIRD PROTECTION	✓	✓	✓			
WIND SHIELD		✓	✓			
ANI-HAIL		✓	✓			
HARVESTING			✓			
FISHING						✓
MILCHING					✓	
PACKAGING				✓		✓
SUPPORT NETS	✓	✓	✓			

PRODUCT	APPLICATION IN AGRICULTURE				ANIMAL HUSBANDRY	FISHING
	CROP PRODUCT	FLORICULTURE	HORTICULTURE	POST HARVESTING		
NONWOVEN FABRICS						
MULCHMAT	✓	✓	✓			
CATTLE SHED UNDERLAY					✓	
PROTECTIVE CLOTHING	✓	✓	✓	✓	✓	
WOVEN FABRICS						
PACKING SACKS				✓		
SUNSCREENS	✓	✓	✓			
PROTECTIVE CLOTHING	✓	✓	✓	✓	✓	
PLASTIC SHEETS						
GROUND COVERS	✓	✓	✓	✓		
GREENHOUSE FILMS		✓	✓			

Table 2

X CONCLUSION

Today, agriculture, horticulture area has realized the need of tomorrow and opting for various technologies to get higher overall yield, quality and tasty agro products. Adopting the hi-tech farming technique, where textile structures are used, could enhance quality and overall yield of agro-products. Textile structures in various forms are used in shade house/ poly house, green house and also in open fields to control environmental factors like, temperature, water and humidity. It also poly avoids agro products damage from wind, rain and birds. Agro textiles like sunscreen, bird net windshield, mulch mat, hail protection net, harvesting net, etc can be used for achieving the above goal.

agro textile plays a significant role to help control environment for crop production, eliminate variations in climate, weather change and generate optimum condition for plant growth Protective screen covering, viz, shade cloth, thermal screen and insect net are tools to further enhance the safety, disease control and productivity of the crop, thus reducing the cost. 'Agro textiles' gives multidimensional views and solutions to the problems being faced by agro industry. Realizing the need of tomorrow, agricultural sector is opting for various technologies to get higher overall yield, quality and tasty agro products.

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