

Applications of Agricultural Textiles - A Review

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Abstract - Textile products now play a very important role in agriculture in terms of climate conditions and production. Agro-textiles prevent soil from drying out to increase crop yield and improve the quality of the product. These textiles protect the farmer against dangerous pesticides. Agro-textile products such as shade netting and thermal screens save 40 % of the energy used in greenhouse heating. The practice of textiles is now also expanding to protect agro-products such as plants, vegetables, and fruits from weather, weeds, and birds, etc. Agriculture is regarded as an industry in many parts of the world to ensure the extensive use of all the land available in the country, irrespective of environmental factors. Environmental control offers plants and crop protection for specific objectives and ensures quality maintenance by eliminating the variations and hazards associated with the weather. Temperature and humidity can be controlled with varying degrees of precision, wind and rain damage can be avoided, nutrients can be regulated to meet plant requirements using green / polyhouse techniques. Textile structures are used both in the greenhouse and in fields as control factors.

Keywords: Agriculture, crop yield, pesticides, quality, greenhouse and textile.

I. INTRODUCTION

Agricultural textiles are one of the wider range of technical textiles also known as agrotech or agrotexiles. In addition, textiles are used to protect crops, fertilization, aquaculture, horticulture, and forestry [1]. As the world's population continually grows, stress on agricultural crops has increased. It is, therefore, necessary to increase the yield and quality of agro-products. However, it is not feasible to use pesticides and herbicides with the traditional methods. Today, agriculture and horticulture have fulfilled tomorrow's requirements and have selected a variety of technologies to lead to higher overall yields, quality and attractive agro-products [2]. The most important requirements for agricultural packages in textiles are weather resistance, microorganism resistance, solid construction, and lightweight. Artificial fibers are a good choice for agricultural products. Man-made fibers offer advantages over natural fibers, especially due to their favorable pay / total performance ratio, ease of transport, space-saving storage and long life. In agricultural applications, the use of non-woven mainly spun bonded fabrics grows at the price of tissue [3]. Adapting to advance farming techniques, wherever textile structures are used, could facilitate the strengthening of agricultural product standards and yields. Textile structures in various shapes are used for shading purposes in shade houses, greenhouses and other open fields to manage temperature, rain, snow, waterfall and humidity environmental factors. Such shaded textile materials are helpful in preventing wind, rain and

bird damage. Besides shading materials, crop protection and weed management are also major challenges. Fruit coloring, growth-stimulating materials, transport-oriented materials, and animal protection materials are predominantly textile product teams used in the agrotech industry [4].

Benefits of Agricultural textiles

1. They are increasing crop production.
2. They avoid drying the soil out.
3. The need for fertilizer, pesticides, and water is reduced.
4. They increase the quality of the product.
5. The first maturation of crops and non - seasonal plants is increased [5].

II. PROPERTIES OF AGRO TEXTILES

Man-made fibers are preferred for agricultural merchandise than the natural fibers, specifically because of their favorable charge ratio, ease of shipping, space-saving garage and long service existence as well as residences along with:

1. Resistance to solar-radiation: Agrotexiles are laid immediately after cultivation or planting on cultivated areas. Agrotexiles must withstand solar radiation at different surrounding temperatures for such applications.

2. Resistance to ultraviolet radiation: Polyethylene is visibly resistant to radiation. However, UV radiation causes molecular chains to degrade. Therefore, polyethylene is

treated with the appropriate UV stabilizers when used as an outdoor material. These are special carbon black types that transform UV radiation into thermal radiation. Good potential to reduce the impact of UV radiation on plants through light absorption or non-woven light reflection (light permeability: 80 to 90 percent to allow photosynthesis).

3. High potential to retain water: This is achieved by using fiber materials that allow a lot of water to be absorbed by filling in super absorbers. While nonwovens intended for plant covering have a weight of 15 to 60 gm / m² per unit area, values between 100 and 500 g / m² are achieved with materials for use on embankments and slopes.

4. Biodegradability: Where the biodegradability of the product is essential, natural fibers such as wool, jute and cotton are also used. Natural polymer gives the benefit of biodegradation but has a low lifetime compared with synthetics.

5. Protection property: Wind protection and the creation of a microclimate between the ground and the non-woven, which balances temperature and humidity. At the same time, root temperatures rise and this results in earlier harvests. Adequate rigidity, flexibility, uniformity, elasticity, biodegradability, dimensional stability and weather resistance. Fungicidal finish (up to 2 percent of total mass) to prevent contamination of the soil [6].

III. APPLICATIONS OF AGRO TEXTILES

Landscape Fabric

Landscape fabric is used to control weeds, a key element in low - maintenance landscape management. Effective weed control means a reduction in actual weeding or the use of herbicides. Spunbonded fabrics are said to be more efficient than woven and non-woven. Needle punched geotextiles to prevent the penetration of fine roots and rhizomes into the fabrics. While non-woven fabric is very strong, it offers plenty of space to penetrate weeds. Needle-bound fabrics have loose material threads through which plants can easily grow. As far as thermally spunbonded fabrics are concerned, these have fibers that keep roots from penetrating.

Wind Protection Fabric

Stringed windshield from commercial grade U.V. Stabilized yarn is often used to prevent wind damage to crops and structures. Air exhaust deflection fabrics are useful for the control of odors. These are often seen in the production of swine and dairy house. The fabric of wind protection is available in a variety of colors that are aesthetically pleasing so that structures are not an eye - catcher on the farm.

Frost Cover Fabrics

Various climates require different levels of protection. Used primarily by professional growers to protect plants and golf courses greens & tee boxes, frost cover fabrics help to protect vegetation during winter or from sudden temperature drops during unwell weather, which can cause extensive damage to landscaping and crops.

Shade Cloth

It is crucial for agriculture to keep the sun from burning vegetation. Shade cloths, mostly made from U.V. commercial grade. Stabilized yarn provides the necessary protection for more sensitive plants and multiple other crops in very hot regions or times of the year. Specific shade cloth applications include shading ginseng, tropical ornamental plants, ferns, all kinds of crops and even livestock.

Sealing Sheets

Fluid tanks, whether water or liquid manure, usually have a boom and resistant sidewall made of prefabricated juxtaposed panels. Some of them are lined with special sealing sheets or tank liners in order to contain fluids and effluents. Sealing sheets proved to be a successful and cost-effective way to solve a wide range of liquid containment problems. They can be adapted to almost all tank forms, sizes and types and are resistant to a wide variety of chemicals, industrial effluents, and other fluids. These urethane blends flexible membranes prevent leakage from under the tank and prevent the flow of expensive and/or contaminated fluids into the ground.

Tarpaulins

A tarp is a large sheet of strong, flexible, water-resistant or water - resistant material, usually covered with plastic or latex. Tarps have several uses, including element shelter (e.g. Wind, rain or sunlight), use as a base sheet for equipment or to protect vehicles or piles of wood. They are also used in outdoor stalls to protect against the weather. Tarps have often strengthened grommets in the corners and on the sides to form rope attachment points.

Anti-Insect Fabric

Anti-insect tissue is a tightly woven U.V. Stabilized polypropylene monofilament bio mesh used in a variety of applications. It has a thickness of 32 thongs per square inch. This gives an average opening of only half a millimeter between the strands. Bio mesh sheets can be used outside in a simple framework to effectively protect against pests as small as 0.5 mm. It can also be used in horticultural and agricultural structures for blocking insects with ventilation openings.

Insulation Nets

Close to transparent insulation nets are used to protect crops from heavy rain, pests, and frost. Its permeable construction enables air and moisture to travel at a reduced and

controlled rate. Isolation nets are often used within a structure as a horizontal curtain to create an overhead thermal barrier. They usually give the crop minimal shading for improved crop performance in duller and cooler winter/spring months.

Greenhouse Light Reflective Flooring

This floor cover option is made from a heavy commercial U.V. grade. Polypropylene stabilized. Its bright white color offers excellent "light available" reflectivity back to dense crop foliage from the floor. Greenhouse flooring is resistant to heavy foot traffic and greenhouse trolley wear and is usually highly breathable to reduce the likelihood that the covered soil will "sour".

Livestock Ground Fabric

High - strength, long-lasting soil tissue is used to keep cattle and other agricultural animals from moist and soft soil patches. Livestock fabrics are used for aggregate roads and roads and under feedlots, as well as for the protection of animals in stalls or holding areas in agricultural operations [7].

Sunscreen (Shade Net)

Warp-strung nets are used to protect fields and greenhouses against intense solar radiation for healthy plant growth and good harvest. Open mesh sunscreen nets are used to control the sunshine and the amount of shade needed. These net structures enable the air to flow freely. The excess heat, therefore, does not build up beneath the screen. The percentage of shadow varies depending on the thread density. The current offer is about 45 percent, 65 percent, and about 85 percent shadow.

Bird Protection Nets

Knitted monofilament nets (open knitted nets for crop protection) provide effective passive protection against damage caused by birds and a variety of pests to seeds, crops, and fruit. Open-mesh fabrics are used to protect fruit planting. The special open structure repels birds, provides minimal shading and excellent air circulation, allowing plants to thrive while avoiding the risk of hazardous fruit molds. The use of polyethylene tape yarns or monofilament yarns makes the net very durable and durable.

Plant Net

Fruit that grows close to the ground can be kept away from the damp soil by allowing it to grow through vertical or tiered nets to minimize the declining fruit. These are made of polyolefin fiber type.

Ground cover

Ground cover is an extremely versatile landscape and horticultural fabric for long-term weed control, humidity preservation, and separation. Ground coverage can reduce costs and minimize the use of unwanted herbicides. It is

mainly used in front and rock facilities, nursery display areas, greenhouse floors, soft fruit beds & orchards, paved areas, horse bridledways & seed harvesting areas. 100% polypropylene is used.

Windshield

Windshields are used in agriculture to protect young plants, fruit, trees or harvests from wind damage. The construction of right angle windbreaks protects young plants and mature plants from dying out and being broken. The nets used here reduce the effects of high winds and even help to keep sand and salt from the air in areas near the sea. The protection of plants against high winds also promotes plant growth and reduces the number of irrigation cycles. Plants are also prevented from being cooled by the wind.

Root ball net

It is extremely important for the safe and speedy growth of young plants such that the root system is not damaged when they are dug up, transported or replanted. Normally the root balls are wrapped in cloth and elastic net tubes are alternative to this. When the plants are transplanted, the nets on the outside have not be removed since the roots can protrude through the nets.

Insect meshes

Various pests such as Whitefly, scale insects frequently attack ornamental plants and vegetables. Clearly, woven and knitted polyethylene monofilament meshes to exclude harmful insects from greenhouses and tunnels or to keep pollinating insects inside, fine woven screens protect plants from attacks by insects (without insecticides).

Mulch mat

Mulch mats are used to suppress weed growth in horticultural applications, cover the soil, block light and prevent competitive wheat growth around seeds. This also reduces the need for weed control herbicides Needle-punched non-woven and black plastic sheets are used for this application, biodegradable and non - biodegradable mulch mats are available.

Monofil nets

Tough, knitted Monofil, windbreak fence nets and shading/screens, a suitable windbreak, set at a right angle to the prevailing wind, protects plants from the harmful effects of blustery weather, which can break young branches, damage flowers and cause leaves to dry or tear. The net also protects against frost and improves microclimate. This protects not only the current harvest but also benefits future crops, as the woody part of the plant is also protected.

Cold and frost control fabrics

Cold and frost can be placed on plants directly, unlike plastic covers that can attract frost and burn any leaf that touches

them. These fabrics protect the plant against freezing in unexpected late and unexpected early cold snaps.

Nets for covering pallets

In order to transport fruit and vegetables safely to the market, the boxes are covered with large mesh nets and pallets to prevent the boxes from turning upside down. This prevents goods from being damaged during transport.

Anti-hailstone nets

Anti-hailstone nets are used to protect plants and fruit orchards from damage to hailstones but do not restrict their growth. The nets are mainly made of monofilament polyethylene.

Harvesting net

It is extremely helpful to those countries where labor charges are costlier. With the application of such nets for harvesting purpose, the labor cost could be reduced considerably. They are laid on the ground or tied under the trees so that fruits fall directly on to them.

Packing materials for agricultural products

For many ends uses, nets can be used for packaging farm products. It includes packing bags for vegetables, tubular fruit packing nets and Christmas trees wrappers, preferred net structures due to their high strength, low weight, air permeability, and cheapness [8].

Fibre used for the manufacturing of agro- textile products

- a. Needle punched nonwoven wool fibers are used for the production of mulch mats.
- b. Jute is widely used for packing agro-products.
- c. Natural polymer gives the advantage of biodegradation but has a low service life compared to synthetic materials.
- d. Manmade fibers used for favorable price/performance ratios, easy transport, installation, space saving for storage and durability.
- e. Synthetic fibers such as polyethylene, polypropylene, polyester, and nylon are commonly used in various forms such as tape yarn, monofilament yarn and multifilament yarn for the production of sunscreen, bird net, windshield, hail protection net, harvest net, etc. [9].

delicious agro-products. A number of studies have shown that, unless certain concrete steps are taken, there is a 10 - 40% chance of loss of crop production in our country due to the expected increase in temperature by 2060. The agro-textile sector is, therefore, working hard to improve the efficiency of crop production by using appropriate agro-textiles to achieve better crop yields year after year. Textiles prove their adaptability to specific geographical locations to be flexible. It is therefore now our turn to shape this infant technology carefully and beautifully, to contribute to the economy of the nation.

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IV. CONCLUSION

Agro-textiles provide multidimensional views and solutions to the agro-industry's problems. In recognition of tomorrow's needs, the agriculture sector opts for different technologies to achieve higher overall yields, quality, and