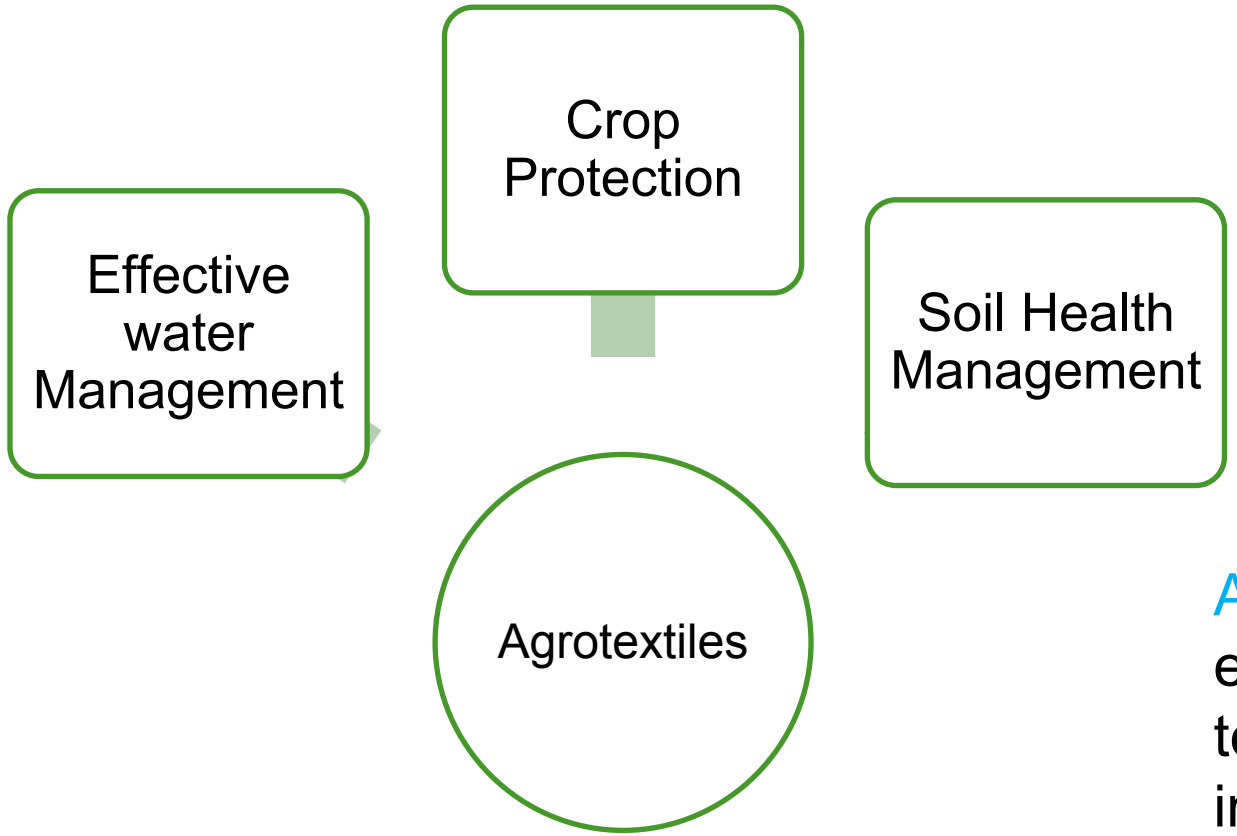
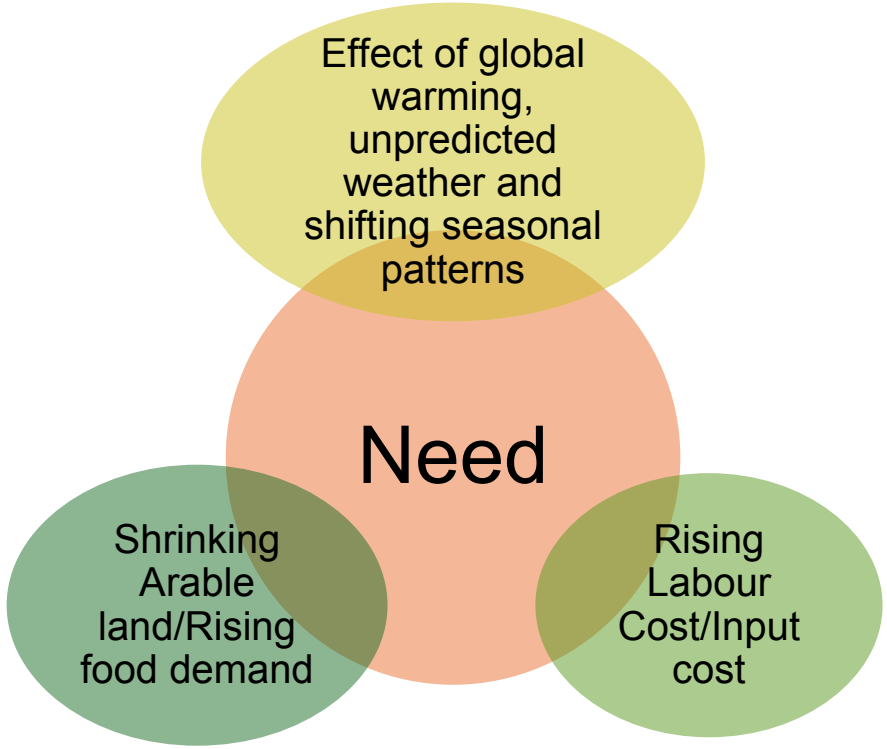
Agrotextiles for Agriculture and Horticulture

Contents

Agrotextiles are specialized technical textiles designed for agricultural, horticultural, and landscaping applications to enhance crop production, protect plants, and manage natural resources efficiently.





Agrotextiles provide solutions for controlling environmental factors such as sunlight, temperature, wind and pests, while also improving soil quality and conserving water

Benefits of Agrotextiles

Enhance crop yield, improve resource efficiency, reduce costs, and promote sustainable farming

Contribution to SDGs

Agrotextiles contribute to several Sustainable Development Goals (SDGs), including zero hunger and responsible consumption and production.

1

Economic and Social Impact

Agrotextiles have a positive economic and social impact by improving livelihoods, enhancing food security, and supporting rural development through sustainable agriculture.

2

Long-term Environmental Goals

The long-term use of agrotextiles supports environmental goals by promoting sustainable farming practices, conserving natural resources, and reducing environmental degradation.

3

Agrotextiles standards under Quality Control Order

SI. No.	IS No.	TITLE
1	IS 15907 : 2010	Agro textiles — High density polyethylene (HDPE) woven beds for vermiculture — Specification
2	IS 16089 : 2013	Jute agro-textile — Sapling bags for growth of seedling/ sapling — Specification
3	IS 16190 : 2014	Agro textiles — High density polyethylene (HDPE) laminated woven lay flat tube for irrigation purpose — Specification
4	IS 16202 : 2014	Agro textiles — Woven ground covers for horticulture application — Specification
5	IS 16390 : 2015	Agro textiles — Nylon knitted seamless gloves for tobacco harvesters — Specification
6	IS 16513 : 2016	Agro textiles — Insect nets for agriculture and horticulture purposes — Specification
7	IS 16627 : 2017	Agro textiles — High density polyethylene (HDPE) laminated woven lay flat tube for use in mains and submains of drip irrigation system — Specification
8	IS 16718 : 2021	Textiles — Polypropylene Spun Bonded Non-Woven Crop Covers and Fruit Skirting Bags for Agricultural and Horticultural Applications —Specification (*first revision*)
9	IS 17070 : 2019	Jute agrotextiles for growth of plant and suppression of weeds — Specification

Agrotextiles standards under Quality Control Order

SI. No.	IS No.	TITLE
10	IS 17356 : 2020	Agro textiles — Windshield nets for agriculture and horticulture purposes — Specification
11	IS 17357 : 2020	Agro textiles — Harvest nets for agriculture and horticulture purposes — Specification
12	IS 17358 (Part 1) : 2020	Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification Part 1 Fencing nets made from extruded polymer mesh
13	IS 17358 (Part 2) : 2020	Agro textiles — Fencing nets for agriculture and horticulture purposes — Specification Part 2 Fencing nets made from mono filament yarns and combination of tape and mono filament yarns
14	IS 17513 : 2020	Agro Textiles — Plant Support Nets for Agriculture and Horticulture Purposes — Specification

Agrotextiles standards under Quality Control Order

SI. No	IS No.	TITLE
15	IS 17728 : 2021	Agro Textiles — High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube and Fittings for use in Rain Irrigation System —Specification
16	IS 17729 : 2021	Agro-Textiles — Flexible Water Storage Tank for Agriculture and Horticulture Purposes — Specification
17	IS 17730 (Part 1) : 2021	Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification Part 1 Warp Knitted Hail Protection Nets
18	IS 17730 (Part 2) : 2021	Agro-Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification Part 2 Woven Hail Protection Nets
19	IS 17731 : 2021	Agro-textiles — Laminated woven orchard protection covers — Specification
20	IS 15351 : 2015	Agrotextiles - Laminated High Density Polyethylene (HDPE) Woven Geomembrane for Water Proof Lining - Specification

Crop Protection

Damage due to extreme sun light

Damage due to hail storm

Damage due to wind

Insects damage, bird damage

Agrotextiles solutions for crop protection

- Shade nets
- Anti-bird nets
- Hail protection nets
- Wind protection nets

Shade Nets

01

Functionality and Benefits

Shade nets protect crops from excessive sunlight, reducing heat stress and preventing sunburn, which enhances crop quality and yield.

02

Types of Shade Nets

Different types of shade nets are available, varying in shading percentages, manufacturing technology and materials, tailored to specific crop needs and environmental conditions.

03

Application Techniques

Proper installation and maintenance of shade nets are essential for optimal performance,durability including correct tensioning.

IS 16008 (Part 1 & Part 2) : 2016

IS 16008 : 2016 (Part 1 & Part 2) Shade Nets for Agriculture and Horticulture Purposes - Specification

- These standard prescribes constructional and other performance requirements for agro shade nets manufactured from tape yarns as well as monofilament yarns for agriculture and horticulture purposes in protecting crop by providing partially controlled climatic conditions for the intended crops.

  - **Part 1 Shade Nets Made from Tape Yarns**
  - **Part 2 Shade Nets Made from Mono Filament Yarns**

- Part I specifies three type of shade nets based on the **shading factor of 50, 75 and 90%**.
- Part II specifies four type of shade nets based on the **shading factor of 35, 50, 75 and 90%**.
- Tape filament shade nets are cost effective, higher shading efficiency for same GSM while monofilament nets offers higher tensile and bursting strength
- The standard specifies the basic performance requirements such as Average breaking strength , Retention of breaking strength after UV exposure, Shading percentage.

Effect of Wind on Crops

Moderate winds

Moderate winds are more than welcome in agriculture if we consider that they help the pollination process, eliminate cold and humid air, reduce the risk of fungal diseases, etc.

Strong Winds

With strong winds growth of the plant slows down. The stress of the wind dries the flowers, interferes with the work of pollinating insects. This leads to a reduction in fruiting and yield. More visible injuries like abrasions and cracks lead to increased plant stress, loss of water and low commercial value crops.

Wind Break Nets for Crop Protection

Microclimate Modification

These nets create a more stable microclimate by reducing wind speed, which helps in maintaining consistent temperature and humidity levels.
This stability is beneficial for crops that are sensitive to environmental fluctuations.

Wind Damage Prevention

Wind protection nets reduce the impact of strong winds, preventing physical damage to crops such as breakage or uprooting.
They also help in reducing soil erosion caused by wind, maintaining soil structure and fertility.

Enhanced Crop Quality

By protecting crops from wind damage, these nets help in producing higher quality fruits and vegetables with fewer blemishes or deformities.
They also reduce the risk of wind-borne diseases, contributing to healthier crops.

IS 17356 : 2020 Agro Textiles — Windshield Nets for Agriculture and Horticulture Purposes — Specification

The Indian Standard IS 17356:2020 specifies the requirements for windshield nets used in agriculture and horticulture to protect crops from high-speed winds. These nets, made from UV-stabilized HDPE monofilament yarn, serve to reduce wind speed and prevent damage to plants.

Key features include different types based on mass and wind speed resistance, the importance of proper installation to ensure durability and effectiveness.

Key Insights

•The nets are are classified based on mass and wind speed resistance.

•Type I - having mass of 100 g/m², *Min*, suitable for wind speed up to 55 km/h; and

•Type II - having mass of 150 g/m², *Min*, suitable for wind speed up to 80 km/h

•The standard specifies performance specifications for breaking strength, bursting strength and wind blockage percentage.

•Standard also covers the installation guidelines for the nets as are vital for

Hail Protection Nets

01

Hail Impact on Crops

Hail can cause significant damage to crops, leading to reduced yields and financial losses for farmers.
Hail protection nets provide a physical barrier that absorbs the impact of hailstones, minimizing damage to crops.

02

Protection Mechanisms

These nets are designed to be strong and flexible, allowing them to absorb the energy of hailstones without breaking.
They also help in reducing the force of hail impact, protecting delicate crops from bruising or breakage.

03

Economic Benefits

By preventing hail damage, these nets help farmers maintain consistent crop yields, reducing the risk of financial losses.
They also contribute to higher quality produce, which can command better prices in the market.

IS 17730 (Part 1) : 2021 Agro Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification *Part 1 Warp Knitted Hail Protection Nets*

IS 17730 (Part 2) : 2021 Agro Textiles — Hail Protection Nets for Agriculture and Horticulture Purposes — Specification *Part 2 Woven Hail Protection Nets*

The standard specifies the construction and performance requirements for hail protection nets made from mono filament yarns for agriculture and horticulture purposes to avoid fruit or flower drop/damage.

Key Insights

The standard specifies two types of nets based on mass (Type-I 60 GSM, Type-II 70 GSM), ensuring varied applications in agriculture and horticulture.

- The standard specifies performance requirements such as breaking strength, bursting strength, UV resistance, porosity and **cold cracking resistance test** to ensure the quality.
- Standards include Installation guidelines to ensure nets are effectively secured, can withstand strong winds.

Feature	**Warp Knitted Nets**	**Woven Nets**
Flexibility	High – stretches and adapts well	Low – rigid structure
Strength	Moderate – good shock absorption	High – better for heavy impacts
Durability	Resistant to fraying, Anti Rip	Better for long term usage
	Lightweight	Heavier
Installation Ease	Easier to handle and install	Can be more challenging to handle

Choosing the right hail net

oven hail nets- or areas with frequent hailstorms and high winds

Knitted Hail nets - For more irregularly shaped areas like orchard cover

IS 15351 : 2015 Agro textiles — laminated high density polyethylene (HDPE) woven geomembrane for water proof lining — specification

- A pond liner is an impermeable geomembrane used for retention of liquids, including the lining of reservoirs, retention basins, hazardous and non-hazardous surface impoundments, garden ponds and artificial streams in parks and gardens.
- This standard prescribes requirements for (HDPE) woven geomembrane laminated with (LDPE) or suitable combination of LDPE and LLDPE for use as lining for canal, pond and reservoir to control seepage**. However, the material is not suitable for lining of roof/terrace and for proper disposal of industrial effluents, etc**.

1. Types:

1. Classified into four types based on thickness and mass:

- Type I — having thickness of **0.25 mm** and mass of **250 g/m²**, min
- Type II — having thickness of **0.50 mm** and mass of **420 g/m²**, min;
- Type III — having thickness of **0.75 mm** and mass of **650 g/m²**, min;
- Type IV — having thickness of **1.00 mm** and mass of **950 g/m²**, min.

1. Key Requirements:

1. breaking load, tear resistance, puncture resistance,
2. seam strength, and hydrostatic resistance are specified for quality assurance.
3. UV exposure tests are included to ensure durability.

2. Installation Guidelines:

1. Details on site preparation, storage, and deployment of geomembranes.
2. Includes guidelines for field seaming, anchoring, and precautions to maintain material integrity.

IS 17729:2021 Flexible water storage tank for agriculture and horticulture purposes

- **Purpose and Scope**: To store water in remote areas where the land is undulated and usage of rigid tanks or concrete tanks is not feasible
    - can be easily transportable from one place to another after the water being used at one place
- **Applications**: Agriculture, horticulture, and other non-drinking water uses.
- **Types and Specifications**
- **Six types** classified by capacity, ranging from 2 kL to 100 kL.
- Tanks are constructed from:
    - **Inner Layer**: Multi-layered polyethylene with a thickness of 125 microns.
    - **Outer Layer**: UV-resistant polypropylene woven fabric.
- **Construction and Design**
- Inner and outer layers are stitched using durable methods with UV-stabilized yarn.
- **Key Requirements**
- **Material**:
    - Inner layer: High tensile strength and resistance to moisture and oxygen.
    - Outer layer: UV resistance, tensile strength, and **environmental stress crack resistance**.
- **Performance**:
    - Puncture resistance and ultrasonic leak testing are specified to ensure the quality.
- **Installation and Maintenance**
- Guidelines emphasize proper site preparation (flat surfaces free from sharp objects).
- Maintenance includes protection from rodents, regular inspections, and ensuring no walking on tanks.

IS 16190 : 2014 High Density Polyethylene (HDPE) Laminated Woven Lay Flat Tube For Irrigation Purpose

- **Purpose:**
- It specifies requirements for HDPE laminated woven lay-flat tubes used for agricultural irrigation. These tubes are designed for lightweight, flexible, and cost-effective water transportation.
- **Key Features and Specifications:**
- **Material**:
    - Made from UV-stabilized HDPE tapes and fabrics laminated with low-density Composed of five layers: two HDPE fabric layers and three laminated coating layers.
- **Performance Requirements specified in standard**
    - Hydrostatic burst pressure: Minimum 2.6 kg/cm².
    - Proof pressure (leakage test): 1.3 kg/cm² for 5 minutes.
    - Retention of strength after UV exposure: 85% of the original strength.
    - Cold-crack resistance: Tested at -5°C with no damage.
    - Puncture strength: Minimum 300 N.
- **Dimensions**:
    - Internal diameters range from 50 mm to 200 mm with specified tolerances.
- **Applications**:
    - Suitable for use in uneven fields, extreme climates, and conditions requiring puncture and UV resistance.

IS 17070 : 2019 Jute Agrotextiles for Growth of Plants and Suppression of Weeds

- **Standard Purpose**: Specifies requirements for nonwoven jute agrotextiles (JAT) for plant growth and weed suppression.
- **Applications**: suppression of weed, Soil conservation, agromulching
- **Features**:
    - Biodegradable, eco-friendly, retains soil moisture, and regulates temperature.
    - capacity to absorb water/moisture up to about 5 times of its dry weight.
    - Enhances soil fertility and nutrient levels upon biodegradation.
- Categorized in 3 types based on gsm 500, 800, 1000.

  Performace requirements to ensure quality:
    - Tensile strength, tear strength, water permeability, and air permeability.
    - Durablility against puncture and bursting forces.
    - Suppresses weeds with minimal chemical

IS 16202 : 2014 Agro Textiles — Woven Ground Covers for Horticulture

Standard specifies constructional and performance requirements for **100 gsm woven ground covers** made from UV-stabilized polypropylene tape yarns.

01 **Weed Suppression**

Agro textiles effectively suppress weed growth by blocking sunlight and preventing weed germination. This reduces the need for chemical herbicides and manual weeding.

02 **Soil Temperature Moderation**

Ground covers help moderate soil temperature, protecting roots from extreme heat or cold. This promotes healthier plant growth and increases crop yield.

03 **Water Conservation**

Ground covers reduce water evaporation from the soil, conserving water and also prevent soil erosion due to winds or loose soil in slopes

Physical Properties requirements

Tensile Strength

The tensile strength of the ground covers should be a minimum of 65 kgf in the warp way and 35 kgf in the weft way.
This ensures that the ground covers can withstand mechanical stresses during installation and use.

Tear Resistance

The tear strength should be a minimum of 30 kgf in the warp way and 18 kgf in the weft way. High tear strength ensures the durability and resistance to tearing during use.

Air and Water Permeability

The air permeability should be a minimum of 20 cft/ft²/s, and water permeability should be a minimum of 7 lt/m²/s.
These properties ensure proper aeration and water drainage, promoting healthy plant growth.

Durability requirements of Woven Ground Covers

Puncture Resistance

The puncture resistance index should be a minimum of 25 kgf.
High puncture resistance ensures the ground covers can withstand physical impacts and maintain their integrity.

UV Resistance Testing

The ground covers must retain at least 70% of their strength after UV accelerated exposure testing.
This ensures long-term durability and performance under continuous sunlight exposure.

IS 17355 : 2020 Agro Textiles — Polypropylene Spun Bonded Non-Woven Mulch Mat for Agricultural and Horticultural Applications

- The standard specifies requirements for **non-woven mulch mats** made from polypropylene. These mats suppress weed growth with minimal chemicals while allowing water, air sto pass through.
- **Key Features of Mulch Mats**
- **Weed Control**: Blocks light to inhibit weed growth.
- **Water Permeability**: Ensures proper irrigation and nutrient flow.
- **Soil Humidity**: Retains moisture, promoting plant health.
- **Lightweight and Easy to Install**: Makes handling and application convenient.
- **Standard specifies 2 Types of spun bonded mulch mats based on GSM**

- **Type 1**: Minimum 50 g/m².
- **Type 2**: Minimum 70 g/m².

- **Performance Requirements**: tensile strength, elongation, UV stability, tear strength.
- Light weight and easy to install as compared to woven ground covers but prone to faster degradation under UV exposure.

IS 15907 : 2010 Agro textiles – High density polyethylene (HDPE) woven beds for vermiculture – Specification

Use in Vermiculture

HDPE woven beds are used in vermiculture to produce high-quality compost for agricultural purposes.

01

Production of Vermicompost

The beds facilitate the production of vermicompost, a nutrient-rich organic fertilizer that improves soil quality.

02

Benefits for Soil Quality

Vermicompost produced in these beds enhances soil texture, quality, and yield, promoting sustainable agriculture.

03

Performance requirements for vermibeds

- **Mass**: Minimum 340 g/m².
- **Breaking Strength**: Minimum 1900 N (warp) and 1300 N (weft).
- **UV Resistance**: Retain 85% of original strength after exposure.
- **Tear and Puncture Strength**: High resistance to ensure durability.
- **Waterproofness**: No leakage under pressure head or cone tests.
- **Chemical Resistance**: Minimal change in mass when exposed to chemicals

Economic and Environmental Impact

Cost Efficiency

HPDE woven beds are cost-effective compared to traditional cement structures, reducing overall agricultural expenses.

Durability and Handling

The beds are durable and easy to handle, making them a practical choice for farmers and agricultural workers.

Environmental Sustainability

Vermicompost promotes environmental sustainability by reducing the reliance on chemical fertilizers and improving soil health.

Conclusion

01 **Key Takeaways**

Agrotextiles offer versatile solutions for crop protection, water management, and soil health, but their success depends on proper selection and implementation. Also, Proper installation and maintenance of agrotextiles are crucial for their effectiveness.

02 **Challenges and Solutions**

Challenges such as high initial costs and lack of awareness can be addressed through education, subsidies, and demonstration projects to showcase their benefits.

03 **Future Directions**

Future efforts should focus on developing cost-effective, biodegradable agrotextiles, smart textiles and expanding their use in diverse agricultural settings to maximize their potential.

Summary of Key Points

Recap of Benefits

Agrotextiles provide numerous benefits, including improved crop yields, reduced environmental impact, and sustainable farming practices, making them essential in modern agriculture.

1

Importance of Agrotextiles

The importance of agrotextiles lies in their ability to address key agricultural challenges, from pest control to water management, ensuring food security and environmental sustainability.

2

Future Outlook

The future of agrotextiles is promising, with advancements in smart technologies and biodegradable materials paving the way for more efficient and eco-friendly agricultural practices.

3


Every thread in Agrotextiles weaves a story of protection, efficiency, and progress for farmers