

sasmira

**A
CONCEPT PAPER
ON
AGROTEXTILES
WITH
SPECIAL FOCUS
ON
PROTECTIVE
AGROTEXTILES**

About SASMIRA

The Synthetic & Art Silk Mills' Research Association (SASMIRA) is a co-operative venture set up by the man-made textile industry of India after independence as a multi-functional institute to serve its scientific and technological needs. SASMIRA was established on 12th January, 1950 after due recognition by the Council of Scientific and Industrial Research under the Ministry of Science and Technology, Government of India. Later it was linked to the Ministry of Textiles. Since then, SASMIRA is engaged in multifarious activities with the prime objective of rendering scientific & technical assistance to the textile industry, thereby assisting its growth and development.

SASMIRA is engaged in various research and development projects in man-made textiles for apparel, industrial and defence applications. Considering the importance of this field SASMIRA had altered its focus towards technical textiles for the past ten years. Various products and processes have been developed viz. geotextiles, Agrotextiles, defence textiles, sport textiles, etc. a few of which have been patented also. Seminars, conferences and workshops are also conducted regularly, both national and international level, to cater awareness in emerging areas of technical textiles. SASMIRA has fully equipped laboratories to carry out testing, evaluation and investigation of a variety of textile and allied materials, with specialised services for technical textiles. SASMIRA laboratories are recognised by International Bureau for Standardisation of Man-made Fibres (BISFA), Bureau of Indian Standards (BIS) and several Government agencies. The laboratory is accredited by NABL

SASMIRA's education programme conduct diploma and certificate courses in various disciplines of textiles e.g. knitting, fashion, apparel merchandising and retail management. In addition to the regular courses on textile technology, processing, knitting technology etc.

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PREAMBLE

Technical textiles are defined as 'textile materials and products manufactured primarily for their technical and performance properties rather than their aesthetic or decorative characteristics. Technical textiles are reported to be the fastest growing sector of the textile industrial sector and account for almost 19% (10 million tonnes) of the total world fiber consumption for all textile uses. Agrotextiles is one of the growing areas of technical textiles. Agrotextiles is 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.

You may be aware that considering the importance of technical textiles, SASMIRA on their own had started various awareness programmes in the form of seminar, workshop and conferences both in national and international level for the past ten years.

SASMIRA is designated as lead agency for Centre of Excellence (COE) for Agrotextiles in association with Man-made Textile Research Association (MANTRA), Surat, Navsari Agricultural University (NAU), Navsari, and IIT Delhi as knowledge partner. As one of the objectives of creating awareness regarding the use and benefits of Agrotextile, products, SASMIRA has gathered and consolidated information on Agrotextiles and compiled it to the present format of a concept paper.

This concept paper will surely enlighten the readers to know all about Agrotextiles.

1. INTRODUCTION

“Agriculture is the backbone of our country” went the saying so far. Now it can be said, “Textile can be the backbone of Agriculture?” A textile fabric has a long history of application in agriculture. The word "agro textiles" now is used to classify the woven, nonwovens and knitted fabrics applied for agricultural and horticultural uses. The practice of textiles is also now widening to safeguard the agro products like plants, vegetables and fruits from weather, weed and birds, etc.

Agriculture is looked upon as an industry in many parts of the world so as to ensure extensive use of all the land available in the country irrespective of the environmental factors. Controlling the environmental factors offers plants and crop protection for specific target and ensures quality maintenance by elimination of the variations and hazards associated with the weather. It is possible to control temperature and humidity with varying degree of precision, avoid damage from wind and rain, regulate nutrients level to meet plant requirement by using green/poly house techniques. Textile structures are used as controlling factors in green house as well as in fields. The main areas of textiles in agriculture include applications in farming, animal husbandry and horticulture. The volumes of special textiles that are manufactured for agricultural applications are increasing day by day not only world-wide but also in India. Also a wide variety of textile products that are designed for general industrial applications are used for agriculture in large quantities. These products include hoses, ropes, conveyor belts, tyres, composites, containers, pots, filters, tarpaulins, sacks, etc. With the apparent exception of protective clothing for insecticides, farmers usually make use of existing fabrics to fulfill their needs.

The most important requirements of textiles for agricultural applications are weather resistance, resistance to microorganism, stable construction and lightweight. Therefore, synthetic fibres are the best choice for agricultural products. The use of textiles in horticulture (fruits, vegetables, nurseries and flowers) is increasing more rapidly than any other area in agriculture. Textiles in different forms are exclusively used for many agricultural end uses it includes knitted, woven, non-woven, extruded sheet, moulded product, ropes, belt, etc. Man-made fibres gives advantages over natural fibres, mainly due to their favourable price / performance ratio, ease of transport as well as setting up, space saving storage and long service life. The use of non-wovens,

especially spun bounded fabrics are increasing in agricultural applications more than woven fabrics.

2. APPLICATIONS OF TEXTILES IN AGRICULTURE

Agrotextiles find application in various fields of applications in different forms. The various areas of application in Agriculture are as follows:

- **Animal Husbandry**

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

- **Horticulture**

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. Trees are covered by nets so as to protect the expensive fruits from birds. Nets are also used for protection against hailstorms, intense sunrays, etc. Light resistant woven and non-woven polyester fabrics are used in the inside of green houses to protect the plants from extreme hot or cold conditions. They are also used on the outside of the green houses as screen to control sunlight. Fabric protective greenhouses provide virus-free cultivation of young plants. 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. Nylon fabric beds are used to grow mushrooms. A mixture of horse manure and compost is laid on the fabric, which is wrapped around rollers to easily remove the mixture.

- **Protective Clothing in Agriculture**

Dermal and respiratory pesticide exposure of agricultural workers involved in spray operations may be significant. Spray operation includes field or row crops spraying, orchard i.e., air blast spraying, spraying in greenhouses, aircraft spraying. Mixing and handling pesticides can penetrate through the fabric by wicking action, wet inner layer of fabrics and skin and be dermally absorbed. Moreover, farm workers are involved in other tasks such as cultivation, harvesting, irrigation, scouting and fruit thinning. Protective clothing is used to reduce exposure to workers that are directly or indirectly involved in pesticide applications.

Wearing of protective clothing such as rubber aprons, waterproof outer garments and face mask for a long period is difficult especially in hot climates. Therefore selection of clothing material is extremely important. The main requirements of the materials are:

- Protection against a range of pesticide formulations, aqueous organic solvent, or oil based
- Lightweight
- Low price
- Readily washable without affecting protective properties
- Durable
- Air permeable to maintain wearer comfort
- Acceptable to wearer

Capillary forces influence the penetration of pesticide through the fabric. Pesticide protective clothing can be made of traditional textiles such as cotton, polyester (or their blend) and treated with repellent finishes. However special woven and non-woven protective materials offer better protection. Protective clothing should not cause heat stress or impair the workers movement. The effectiveness of protective clothing is influenced by garment properties (fibre type, yarn and fabric geometry, textile finish), environmental conditions and pesticide characteristics. Fluorocarbon finishes provide better protection against pesticide penetration than non-fluorocarbon-finished fabrics and reduce wicking.

3. RAW MATERIALS FOR AGRO-TEXTILES

Manmade fibres are preferred for many agricultural end uses than natural fibres mainly due to their favourable price/performance ratio, ease of transport and setting up, space saving storage and long service life. The most important requirements of textiles for agricultural applications are weather resistance and resistance to microorganisms. Therefore, synthetic fibres are the choice of material for designing of agro-textile products. Synthetic fibres like, Polyethylene, polypropylene, polyester, nylon are widely used. While in use for outdoor application, agro-textiles are laid over the cultivated areas immediately after sowing or planting, and remains there for at least four to five seasons, for such outdoor application agro-textile has to withstand solar radiation with varying surrounding temperature. Agro-textiles made of

synthetic materials are not susceptible to rotting. Synthetic polymers in different forms like, tape yarns, monofilament yarn, and multifilament yarn are commonly in use for manufacturing sunscreen, bird net, windshield, hail protection net, harvesting net, etc.

Polyethylene is resistant to radiation in the visible range; on the other hand, long-term radiation in the ultraviolet range leads to degradation of molecular chains. For this reason polyethylene is modified in the appropriate way. For use as an outdoor material it is treated with the appropriate ultraviolet stabilisers. These are special types of carbon black, which convert the ultraviolet radiation into thermal radiation. This incorporated ultraviolet stabiliser improves product service life.

Narrow polypropylene and polyethylene tapes or fibrillated yarns are extensively applied for knitted and woven agro-textiles. Furthermore, polypropylene tapes / polyethylene or polyester monofilaments are also applied for manufacturing of woven and knitted agro-textiles. Monofilaments are also used, the main advantage of monofilament yarn is that, it presents a smaller working surface to solar radiation because of their circular cross-section and are therefore more light resistant and stable. Polypropylene polymer is extensively used for the manufacturing of spun-bounded non-woven 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 biodegradability of product is essential. A wool fibre, in needle punched non-woven form is used for the manufacturing of mulch mats. Jute is exclusively used as a packing material for agro-products. Natural polymer gives the advantage of biodegradation but, has low service life compared to the synthetics.

4. PRODUCTION TECHNIQUES FOR AGRO-TEXTILES

Several techniques of fabric production can be used to produce agro-textiles; each method offers specific advantages for particular product. Weaving, knitting, non-woven, braiding composites etc. can be used to produce variety of agro-textiles.

a) Knitting

Warp knitting technique is most widely used compared to the weft knitting. Warp knitted protective nets are used in different sectors,

which are produced on raschel machines. On the raschel machine the yarn passes through i) Warp beam ii) Knitting elements, on their way to fabric batcher. The yarns are fed in the form of warp beams. The yarns are drawn off these and fed vertically to the working needles via yarn guides. The knitting element converts the yarn in to stitches. After stitch formation the knitted net is removed via a take-off mechanism and batched up or plaited down.

Products Covered:

Nets for the root balls of plants, nets for protecting grassy areas, nets for protecting crops from birds, nets for protection against hailstones, sun screens, windshields, harvesting nets, packing materials.

Technology:

Warp knitted protective nets are used in different sectors, which are produced on raschel machines. On the raschel machine Like DR 5 SS or DR 7 S or RS 4 N raschel machine with width of 2667-5334mm.

The yarn used in agro-textiles like PP or HDPE are in the form of flat tapes, folded tapes, split tapes, fibrillated tapes and filament tapes. They are wound on cheeses with no twist inserted. Winding heads at the delivery end of the range producing tapes are usually of the form excluding the necessity to rewind tapes prior to further processing. Thus rewinding is done on winders for coarse yarns with precision winding. Fibrillated tapes should be twisted especially if they are used in warps. The twist level of 40-80 tpm is generally sufficient.

In addition to the conventional yarn supply on warp beam, there are alternative ways of feeding the yarn, which, depends on further processing, permit more efficient production. The first of the three possibilities is directly drawing the tape yarns from a creel. This is the most productive form of yarn supply. In the second method of yarn supply machine can be supplied with rolls of mono-axially-oriented film, which is then guided over a knife comb. There the film is slit into tape yarns, which are then fed in to the knitting elements. The device used here is the film-slitting machine (FSM). The third and last possibility is an "in-line" method, where the slitting of primary film in to tape yarns and its subsequent drawing are linked up to form one integrated operation.

Agro nets are produced in various constructions or lapping. Here, the

construction or lapping is the way in which individual yarn systems are converted into fabrics. For protective nets a chain is usually combined with an inlay or a two-needle underlap construction, i.e. two guide bars are necessary for producing agro net. Characteristic of Warp Knitted Fabric are as follows:

- Knot-free joints when manufacturing nets and consequently greater strength lower weight and less resistance while pulling the net.
- Economical use of materials since an extremely open fabric can be produced without slip by the help of non-slip loop construction.
- Adjustable fabric density, if the net is to be used as a shade, the amount of sunlight that may pass through can be specified.
- Adjustable dimensional stability, it can be from elastic to dimensionally stable fabric.
- High production efficiency due to high operating speed and large working width.

b) Weaving

Woven textile structures are also employed for agro-textile application. Woven agro-textiles are used for ground cover, sunscreen fabric, etc. for horticultural application. Some of the producers of agro-textiles all over the world are manufacturing open-mesh fabric in leno construction from tape and monofilament yarn. Woven products are produced by using weaving machines especially projectile weaving machines. The range of light to heavy and wide width fabric production is possible with projectile weaving machine. The number of leno shafts, which are equipped with wear reducing plastic lifting heads, determines the maximum machine speed. Nevertheless, it is still possible to attain the weft insertion rate of more than 1000 m/minute. The special tucked-in selvedge is sufficient to meet the subsequent tensile load on the fabric. Batch winders positioned in front of the machine wind the fabric on to roll, from which it can be rolled directly off and over the fruit plantation to be protected. Fabric does not require any finishing.

Products Covered:

Shade nets of varying in optional direction, three dimensional nets, Multilayer nets, Tarpaulins, Geotextiles in horticulture like ground

stabilisers, reinforces, drain liners, seed protector, cliff and slope erosion protectors.

Technology:

Woven textile structures are also employed for agro-textile application. Woven agro-textiles, which are lightweight, are used for ground cover, sunscreen fabric, etc. for horticultural application. Some of the producers of agro-textiles all over the world are manufacturing open-mesh fabric in leno construction from tape and monofilament yarn. The range of light to heavy and wide width fabric production is possible with projectile weaving machine. Machine with weaving width of 540 cm. and 846 cm. are available for the production of agrotexiles. The nets with a mesh width of 1.8 mm. to 40mm. can be produced.

In order to produce stable, open mesh, lightweight woven cloth construction with high productivity Sultex has recently developed a special mechanism for production of leno construction on projectile machine called "Power Leno Technique" which is superior in operation than intensive conventional weaving machine. Its superiority is based on the following advantages:

- No expensive leno harness with leno healds causing wear
- Much smaller motion than with conventional leno harness
- Easy to operate
- Low warp yarn loading
- Low warp loading – fewer yarn breaks
- Higher machine speed (maximum weft insertion rate of 1300 m/min) and therefore high productivity.
- Available in wide working width.

Other systems of woven fabric production such as air jet and rapier weaving machines are not preferred for the manufacture of such fabrics, as they do not have the required weaving width.

c) Non-woven

There are many techniques to produce Nonwoven fabrics.

- Needle-punched nonwovens
- Stitch-bonded nonwovens

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- Thermally bonded nonwovens
 - Hydro entangled nonwovens
 - Spun bonded nonwovens
 - Wet nonwovens

Out of these spun bonding and needle punch techniques are mainly used for the production of non-woven agrotextiles. The spun bonded fabric have a high and constant tensile strength in all directions, also it has very good tearing strength due to the random arrangements of the filaments in the web. While in needle punching process bonding of the fibrous web is the result of intertwining of the fibres and of the increased interfibre friction caused by the compression of the web by needles. Needled fabric from natural as well man-made fibres are produced on needling machine.

Spun bonding is a technique in which a melt or solution of a fibre forming polymer is extruded through a system of spinnerets in to a high velocity current of air for drawing purpose and the fibres thus formed are deposited on to a high velocity current of air for drawing purpose and the fibres thus formed are deposited on to a perforated continuous belt to form a spun web fabric.

Products Covered:

Crop cover over plants and seedlings, mulch mats.

Needle punched fabric plant bags provide advantages over conventional fired clay pots. Bast fibres like flax or jute are also especially suitable for this kind of production. All natural fibres offer an added advantage of that; the container decomposes after being planted in the ground. Even with the non-woven product from man-made fibres the roots find their way through the fabric. Needle punched fabric bags need no re-potting when transplanted in to the soil. Lightweight spun web type non-woven is mainly used as a covering material for plant growing applications in horticulture and agriculture. For blanching application a breathable spunweb non-woven fabric has been developed, which filters, certain light wavelengths and reduce the production of green coloured chlorophyll. These photo selective spunweb has a density of around 90 g/m. and includes light reflective particles and pigments which enable the covering to selectively absorb certain wavelengths of visible light. The density of fabric is such that any light waves are perfectly filtered.

Water and air permeability is maintained, and these have been adjusted by altering the relevant pore size of the fibre space in the non-woven sheet, thus providing a balanced microclimate for plant growth. A spun bonded fabrics which provides durable agricultural crop cover fleece, is lightweight (17-20 g/m²) with improved tensile strength, tear strength and abrasion resistance. Specifications of few spun web crop cover are given below:

- Lutrasil Thermoselect, white in colour with 17 g/m², for use as a pest control for vegetable crops and as an interior covering sheet for unheated green houses. It has 92% light permeability and is available in widths of 110-1050 cms with roll lengths of 500-1000 m.
- Lutrasil Frostselect, white in colour with 30 g/m², for use as winter covering for vegetable crops, ornamental plants and bushes and also with limited shading application. It has 85 % light permeability, is available in the widths of 200-1050 cms. and roll lengths of 100-250 m.

d) Finishing and Coating:

The finishing of agro-textile products woven, knitted or nonwoven would demand the following finishes depending upon the end use requirement:

- Heat setting
- Calendaring
- Coating and laminating
- Stitch bonding

5. AGRO TEXTILES PRODUCTS IN HOTICULTURAL APPLICATIONS

Wide varieties of agro textile products are available and the selection of suitable type of products depends on the protection of the crop. Selection of the agro textile is greatly influenced by the geographical location. At some location agro textiles are used to protect the plantation from excessive sunlight while at some places it is expected to protect plant from cold. Therefore selection of agro textile is done as per the location and the desired protection from the external agencies. With the use of high quality agro textiles quality and yield of agro products can be enhanced.

Some of the applications of agro textiles used for horticultural applications are follows:

i) Sunscreens

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.

ii) 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 mould developing on the fruit.

iii) 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.

vi) 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 provides weed suppression and ground moisture conservation, whilst allowing roots to breathe and water, air and nutrients to permeate through. This maintains higher soil temperatures and promotes more rapid and even plant growth. It has a high degree of UV stabilizer added to protect it from the harmful effects of exposure to sunlight. It effectively suppresses competitive weed growth, conserves ground moisture, maintains a clean surface, and creates a favorable environment for health 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 hardwearing surface. While the pre-marked white grid aids spacing. In orchards and fruit beds the fabric is regularly used to maintain a clean crop and reduce maintenance and disease problems.

v) 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 the wind.

vi) Harvesting nets

These nets are entirely made of UV stabilised polyethylene monofilament. The nets available have various kind of meshes in order to optimise the different harvesting methods of olives and fruits. Every net is suitable for a different application such as natural falling harvesting, hand harvesting or mechanised harvesting.

Vii) Root ball net

It is extremely important for safe and speedy growing of young plants 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.

viii) Insect meshes



Fine, woven, meshes which resist insect penetration.

Clear, 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). Insect meshes can also be placed over the openings of greenhouses to prevent pollinating insects, such as bumblebees, from escaping.

ix) Turf protection net

Nets are put over the grassy areas on riverbanks; dykes etc., so that lumps of earth are not removed while animals are grazing them. This will help in minimizing soil erosion loss and improve conservation.

x) 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 non-woven and black plastic sheet are used for this application. Bio degradable and non-biodegradable types of mulch mats are available.

xi) Monofil Nets



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. They can also be used to block sand and salinity as well as reduce wind erosion. The nets also protect against frosts and help enhance the microclimate (Photosynthesis, and ground moisture, is improved by reduced evaporation and transpiration). While special anti-hail net grades have been designed to withstand the impact of heavy hailstorms, when installed in roof-profile above crops and orchards. This not only safeguards the current harvest but also benefits future crops, since the woody part of the plant are protected too.

xii) Tape nets



Tape Nets

Knitted flat tape nets are available in a wide range of densities for shade, reduced sunlight intensity, fruit support, privacy screening and animal protection. The nets are practical, economical and easy to install; creating ideal growing conditions by avoiding overheating, scorching and moisture loss. The low shade



factor nets are used for growing vegetables, while those with medium light-reduction/screening offer ideal conditions for storage areas, cultivating flowering plants/houseplants and acclimatizing plants moved out of greenhouses. In the area of agriculture it is possible to use non-woven blanket fabric that is permeable for water, air and light and during vegetation it creates microclimate optimal for the plant development and growth. Plants are protected against weather changes (short-term frost), strong wind, hail and pests. Light weight, knitted tape, nets for shade and In the alternative agriculture, they often use black mulching fabric that is laid directly on the soil and prevents the growth and spread of weed, which significantly decreases or eliminates the need of herbicides. This fabric is water permeable; it allows the soil to get warm, minimizes non-productive evaporation and prevents creation of soil crust. Commercially a few non woven fabrics manufactured by spun bond technology are used as Barrier fabrics is barrier quality, which is used for manufacturing of single-use products.

Xiii) Cherry covers

Growing cherries has proved an uncertain business because of their vulnerability to the weather damage - especially during the blossom, stoning and fruit ripening periods. The new cherry cover system has been specifically designed to tackle these problems; offering protection throughout the season from frost, rain, hail and wind. The fabric is very tough, with a high degree of UV stabilization (to protect against breakdown in sunlight), so will provide many years of use, and the suppleness makes it very easy to handle. The unique property of this



system is unrivalled performance. The cover creates a micro-climate (without hindering ventilation) which gives protection against adverse weather conditions - improving both quality and yields.

xiv) 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 to goods during transportation.

xv) 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
- Wrappers for Christmas trees
- Net structures are preferred because of their high strength, low weight, air permeability and cheapness.

6. MARKET SCENARIO

Agro textile is one of the significant segments of technical textile products, occupying a significant place in terms volume consumption. Table 1 depicts the volume of consumption of agro textile products as compared to other technical textile products. It may be seen that worldwide the volume is about 10% of the total consumption of technical textiles. However, the agrotech products become significant in the developing countries, where agriculture is the backbone of economy.

Table 1: Consumption pattern in various segments of technical textiles

Technical textile Segments	2000		2005		2010	
	Volume ('000 tones)	Value (US \$ mn)	Volume ('000 tones)	Value (US \$ mn)	Volume ('000 tones)	Value (US \$ mn)
Agro-tech	1,381	5,541	1,615	6,568	1,958	8,079
Build-tech	1,648	5,872	2,033	7,296	2,591	9,325
Clothtech	1,238	6070	1413	7014	1656	8306
Geotech	255	740	319	927	413	1203
Homotech	2,186	6750	2499	7622	2853	8778
Indutech	2205	13405	2624	16687	3257	21528
Medtech	1543	5391	1928	6670	2380	8238
Mobiltech	2479	25629	2828	26861	3338	29282
Packtech	2552	4393	2990	5329	3606	6630
Protech	238	5193	279	5873	340	6857
Sporttech	989	13897	1153	16052	1382	19062
Total	16714	92881	19681	106899	23774	127288

Agriculture is looked upon as an industry in many parts of the world so as to ensure extensive use of all the land available in the country. With the advent of organic farming where consumers are becoming more aware of green movement, which abhors the use of harmful chemicals in the environment has precipitated the need for an alternative to pest and herbicides.

i) World – wide Scenario:

Table 2 highlights the region wise consumption of agrotech products.

Table 2: World End-Use consumption of Agro-Tech

S. No.	Volume ('000 tonnes)	Year		carg%	
		2005	2010	00-05	05-10
1	North America	150	152	-0.2	0.3
	USA	135	137	-0.2	0.3
2	South America	117	142	2.3	4.0
	Brazil	44	53	0.3	0.9
3	Western Europe	250	261	0.3	0.9
	France	40	41	0.1	0.7
4	Eastern Europe	72	93	4.7	5.1
5	Middle East	51	63	2.6	4.1
6	Central Asia	14	16	2.6	3.7
7	South Asia	195	269	5.9	6.7
	India	154	215	6.2	6.9
8	North East Asia	504	630	4.8	4.6
	China	389	509	6.2	5.5
	Japan	61	62	-0.2	0.4
9	South East Asia	158	205	4.7	5.4
10	Africa	93	110	2.3	3.5
11	Oceania	13	16	3.1	4.1
	Total	1,1615	1,958	3.2	3.9

Identified and forecast by DRA report, World Market forecast, 2010.

The use of geotextiles for landscaping, and also in the garden for ground stabilization, weed control, pest control etc. system. This has given an boost for exports potential of agro-tech products. With the accelerated world end use consumption from 3.2% in 2005' to 3.9% in 2010'

(source DRA), it is derived that there is a growing demand for usage of such products under this application segment. According to DRA in India the CARG% is expected to accelerate from 7.0% in 2000 to 7.2% by the year 2010.

Worldwide growth of agro-textiles does not show a significant growth. The agro-textile market is expected to grow from 1615 thousand tones (US \$ 6.5 Billion) in 2005 to 1958 thousand tones (US \$ 8.1 billion) in 2010. This growth is expected to be at the average rate of 3.9 % per annum. However, if we consider the region wise growth, it may be seen that in the developing regions like China, Brazil and particularly India with CAGR 7.8%, there is a tremendous potential for consumption of agro-textiles.

ii) Domestic Scenario:

In continuation to the consumption of technical textiles worldwide, the importance of agrotexiles and its relevance to developing countries like our nation is well brought out. India being a tropical country specific agrotech products is in good demand like shade net, bird net, mulch mat, packing sacks, etc. The actual figures are as given in Table 3.

There is continuous decline in production of the crops in comparison with the increase population. The food security has become a major problem in India and worldwide that is accentuated by the threat of climate change. Some studies have revealed a probability of 10 to 40% loss in crop production in the country due to the anticipated rise in temperature by 2050-2060. So there is tremendous scope for the development of the agro-textiles. The market for agro-textiles is expected to grow from present Rs. 552.7 crores to Rs. 900 crores in 2010. The market for agro-textile is expected to grow at an average of 10 percent per annum.

Table: 3 Consumption of Agrotextile Products in India

Product		2007 -08				2012-13
		Production	Import	Export consumption	Domestic consumption	Domestic
Shade-nets	Quantity	5,000 MT	-	2,200 MT	2,800 MT	3,747 MT
	Value	Rs 45.5 crore	-	Rs 17.5 crore	Rs 28 crore	Rs 37.5 crore
Greenhouse films	Quantity	700 MT	900 MT	-	1900 MT	2736 MT
	Value	7.8 crore	15 crore	-	22.8 crore	32.8 crore
Mulch-mats	Quantity	1,050 MT	-	115 MT	900 MT	7,000 MT
	Value	14.1 crore	-	1.5 crore	12.6 crore	98 crore
Crop-covers	Quantity	1000 MT	-	1000 MT		
	Value	10 crore	-	10 crore		
Others	Value	472 crore	11.6 crore	37.5 crore	446.1 crore	573.75 crore
TOTAL	Quantity	24,868 MT	1,875 MT	5,665 MT	21,078 MT	33,390 MT
	Value	Rs 549 crore	Rs 27 crore	Rs 67 crore	Rs 510 crore	Rs 742 crore

Table: 4 Detail analysis of consumption of potential protective agrotextile products :**1. Shade-nets usage in India**

Existing penetration	Over 5,000 hectares
Total Potential area	1 lakh hectares
Life of shade-nets	4 years
Annula shade nets usage targeted as per NHM state action plans (adjusted)	1,600 hectares
Average price	₹ 10 to 22 per square meter (for GS _m 100 to 200) (for ₹ 100 per kg.
Share of applications other than agriculture in shade-nets usage	20% of total usage
Total shade-nets consumption	₹ 28 crore approx

2. Mulch-mats usage in India

Existing penetration	Over 10,000 hectares
Total Potential area	10 lakh hectares
Life of mulch-mats	0.5 to 4 years (Average Life of 2 Years at present)
Annula mulch-mat usage targeted as per NHM state action plans (adjusted)	6000 hectares
Average price	₹ 140 per kg 100 per kg.
Total mulch-mats consumption	₹ 12.6 crore approx

3. Anti-hail nets usage in India

Existing penetration	Over 50,000 trees
Life of anti hail nets	7 to 8 years
Annula Anti-hail usage targeted as per NHM state action plans (adjusted)	20,000 trees (at around 200 trees per hectare)
Average price	₹ 32 per sqm
Total anti-hail consumption	₹ 3 crore approx

4. Bird-protection nets usage in India

Annula bird protectionl usage targeted as per NHM state action plans (adjusted)	Around 100 hectare
Average price	₹ 11 per sqm
Total bird-protection consumption	₹ 1 crore approx

Table 4: List of Agrotech Manufacturing Industry

Sr. No.	Name	Address	Products
1	Gujarat Fisheries unit	Ahmedabad, Gujarat	Fishing Net & Fishline cargo nets, twine, etc.
2	Ruparel Plastics	Mahuva , Gujarat	Fishing nets, cargo nets, twine, etc.
3	Makharia Netting	Dahod, Gujarat	Fishing net & Fishline
4	J.K. Industries	Rajkot, Gujarat	Fishing net & fishline
5	Globe Cast	Umbergaon	Fishing net & fishline
6	Chain Synthetics(P) Ltd.	Porbandar, Gujarat	Fishing net & fishline
7	JayshreeMarine nets	Nani Daman	Fishing net & fishline
8	Khetan TwistNet(P) Ltd.	Mumbai	Fishing net & fishline
9	Fisheries (P) Ltd.	Bardoli, Gujarat	Fishing net & fishline
10	Amar Polyfilms	Porbander, Gujarat	Fishing net & fishline
11	Tuflex India (www.tuflex.net)	Vadodara, Gujarat	Agroshade Net
12	Agrotech	Anand, Gujarat	Agroshade Net
13	Technofabrics	Udhna, Gujarat	Agriculture Net
14	Rishi Packer	Silvassa	Crop Protection Net
15	ARD Polymer	Silvassa	Crop Protection Net
16	Unimin	Silvassa	Shade Net/fabrics
17	Fiberweb India Ltd	Silvassa	Woven & nonwovencrop covers
18	Malmo Exim	Mumbai	Shading nets, mulchmats
19	Kwality nets	Mumbai	Shading nets
20	Netlon	Baruch	Shading nets
21	Mysore Nandi Tarpaulins Mfg. Co.	Secunderabad, Andhra Pradesh	agricultural shade nets
22	Planet Plastics	Nagpur, Maharashtra	shade net and anti bird net

Sr. No.	Name	Address	Products
23	KT Exports (I) Pvt. Ltd	Mumbai, Maharashtra	shade nets such as agriculture nets, windbreaker nets, bird nets, weed control - non woven, geolay and frost cover
24	Ever Green Industries	Coimbatore, Nadu Tamil	shade net
25	Affy Export India Pvt. Ltd	Ghaziabad, Uttar Pradesh	nets, shade nets, agriculture net, scaffolding nettings, silt fence, woven fabric and ground covers.
26	CTM Technical Textiles Limited	Ahmedabad, Gujarat	agro shading nets
27	Sree Durga Industries	Coimbatore, Tamil Nadu	shade nets
28	Creative Plastics	Mumbai, Maharashtra	shading net, insect net, bub sleeves
29	Bhindarwala Traders	Mumbai, Maharashtra	anti-bird nets, safety nets, shading nets, throwing fishing nets, nylon fishing twine, nylon fishing line
30	Neo Sack Limited	Pithampur, Madhya Pradesh	HDPE/ PP woven sacks, raschel bags, bags with tie-string, shade nets and other allied products
31	Phuar Agrotech	Delhi Cantonment, Delhi	shade net, insect net and irrigation components
32	Ratna Fiber Industries	Bangalore, Karnataka	insect proof nets, window mesh, "UV Stabilized" agro shade net, anti-virus nets,
33	India Plastic Associates	Vadodara, Gujarat	garden fencing and shading net.
34	Premier Tarpaulins	Coimbatore Tamil Nadu	Tarpaulins, shade nets, pond liners, chilly drying mats
35	Bokaria Meshes and Wires	Chennai, Tamil Nadu	plastic shade nets, light weight nylon shade nets, colored shade nets, window screen shade nets and nylon shade nets

Sr. No.	Name	Address	Products
36	Br Agri Factors	Daman	Shade nets and monofilament nets
37	Essen metals & alloys	Pune, Maharashtra	Shade Net, Shade Net Ropes, Insect Nets
38	Reach netting Solutions Pvt. Ltd.	New Delhi	Shade nets, bird protection nets, monofilament nets
39	Shree Siddhivinayak Polyhouse	Pune, Maharashtra	Fabricator natural ventilated greenhouse, poly house, tunnel type shade nets.
40	Super Paulin	Coimbatore, Tamil Nadu	Shade nets
41	Gulati Canvas	Delhi	Shade nets, Canvas
42	Lepakshi Tarpaulin Industries	Hyderabad, Andhra Pradesh	Agriculture Shade nets
43	Bharat Tarpaulin Co.	Bangaluru, Kamataka	Shade nets, tarpaulins
44	Flora Agrotech	Vapi Gujarat	Shade nets, monofilament nets
45	Indonet Plastic Industries	Vadodara, Gujarat	Shade nets,
46	Neelgiri Tarpaulin Co.	Salem, Tamil Nadu	Shade nets, tarpaulins, Poultry shed
47	R. R. Polynets	Valsad, Gujarat	Shade ents, insect nets, bird protection net, pond liners
48	Agro-tech	Anand, Gujarat	Shade nets, vermicompost bed, poultry shed nets
49	Betala Canvas Co.	Chennai, Tamil Nadu	Shade nets, Tarpaulins,
50	Rajdeep Agri Products Ltd.	Delhi	Shade nets,
51	Hind Fab	Ahmedabad, Gujarat	Shade nets, Packing sacks, Tarpaulins
52	Creative Polymers	Halol, Gujarat	Shade nets, Horti pots

Sr. No.	Name	Address	Products
53	Rajvi Plastotech Pvt. Ltd.	Vapi, Gujarat	Shade nets
54	Fortune Agro nets	Vapi, Gujarat	Shade nets, poly sacks
55	Hari Om Polysacks	Vapi, Gujarat	Shade nets, polysacks
56	Venkatesh Agro shde nets	Vapi, Gujarat	Shade nets,
57	J. B. Packaging	Ahmedabad, Gujarat	Shade nets, insect nets
58	Balaji Polynets	Vapi, Gujarat	Shade nets

7. CONCLUDING REMARKS:

India being a tropical country with 50% Indian population depending directly or indirectly on agriculture as a main source of income. The need to feed an ever-expanding population is, however, underlying driving force behind the agro-tech sector. In many developed as well as developing countries the area of land dedicated to agriculture and horticulture is declining. Agro-tech textiles can contribute towards this goal, for example by artificially controlling the climate for plants and animals. The principal function of most agricultural textiles relates to protection of food produced, animals or land, which are the important amenities of living being.

The most commonly used textile product by Indian farmer is shade net and mulch mats. The Indian farmers are most conscious about the cost and service life of the products. There is a large potential of development for agro-textiles in India in near future. Lack of awareness among Indian farmers and high cost of agro-textiles are the limiting factors for growing popularity in India. Extensive use is also made by the agrotech sector of textile products classified to other application areas such as Geotech, Indutech, Mobiltech, Packtech and Protech. Thus the importance of agriculture and fishing to technical textiles industry is clearly even higher than shown for AgroTech alone. Certain agencies like agricultural institutes, co-operative societies and consultants have to play an important role in bridging the gap and convey the technology to farmers.

The COE, Agrotech would assist the industry with training demonstration, apart from creating awareness and knowledge sharing. The textile entrepreneurs would be guided with help of project profiles on various agrotexile project and would also be provided standards and norms for processing.

SASMIRA's CENTER OF EXCELLENCE - AGROTEXTILES

SASMIRA has been designated as a Centre of Excellence for Agrotextiles. The centre will be set – up in alliance with MANTRA, Surat, Navsari Agriculture University, Navsari as associate partners and IIT, Delhi as knowledge partner. The vision and Mission of the COE, Agrotextile can be stated as:

VISION

“To become a world class leading service driven and research based international technical textile association to serve the industry in general and agriculture sector in particular”

MISSION

- Creating awareness regarding agrotextiles products amongst agriculturist
- To increase productivity by protection of crops
- To assist in early harvesting by use of agrotextile products
- Providing Soil covering systems and controlling irrigation using agrotextiles
- To create state-of-art testing certification facilities for agrotextile products
- To assist the industry for entrepreneurship in the field of agrotextiles

FACILITIES

This centre will achieve its vision and mission through the facilities and infrastructure,

- Demonstration pilot plant facility for Agrotextiles
- Accredited Testing and evaluation facility for Agrotextiles
- Information centre for Agrotextiles
- Training Centre for Agrotextiles
- Product development & Incubation facilities.

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