DRAFT TANZANIA STANDARD

Agro-textiles - Windshield nets for agriculture and horticulture purposes - Specification

Draft for Stakeholders' Comments Only

TANZANIA BUREAU OF STANDARDS

Foreword

This Draft Tanzania Standard is being developed by the Specialized Textiles Technical Committee under supervision of the Textile and Leather Divisional Standards Committee and it is in accordance with the procedures of the Bureau.

In the preparation of this standard, assistance has been obtained from the following standard:

IS 17356: 2020 Agro-textiles - Windshield nets for agriculture and horticulture purposes - Specification

In reporting the result of a test or analysis made in accordance with this standard if the final value, calculated or observed is to be rounded off, it shall be done in accordance with TZS 4 *Rounding off numerical values.*

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1. Scope

This Draft Tanzania Standard prescribes constructional and other performance requirements for windshield nets manufactured from monofilament yarns for agriculture and horticulture purposes to protect the flora from the damage caused by high-speed wind by reducing or blocking the amount of wind passing through them.

2. Normative reference

For the purpose of this Draft Tanzania Standard, the following references shall apply. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies:

TZS 4 *Rounding off numerical values.*

ISO 13934-2 *Textiles — Tensile properties of fabrics Part 2: Determination of maximum force using the grab method*

TZS 21/ISO 7211-6 *Textiles — Methods for analysis of woven fabrics construction — Part 6: Determination of the mass of warp and weft per unit area of fabric*

TZS 23/ISO 105-B02 *Textiles - Tests for colour fastness - Part B02: Colour fastness to artificial light: Xenon arc fading lamp test*

TZS 262 *Textiles – Yarn from packages – Determination of linear density (mass per unit length) – Skein method*

TZS 4455-1/ISO 13938-1 *Textiles-Bursting properties of fabrics - Part 1: Hydraulic method for determination of bursting strength and bursting distension.*

3. Terms and definitions

For the purpose of this Draft Tanzania Standard the following definitions shall apply:

3.1 windshield nets

textile fabrics that protect the crops from exposure and damage from highspeed wind.

3.2 wind blockage percent

the term for expressing the quantification of the amount of wind passing through the sample and gives the capacity of the net sample to block the amount of wind passing through the sample.

3.3 open area percent

percentage of the totalarea of a net sample that is not occupied by the threadsof the weave, which is that portion of the fabric area through which wind can pass.

4. Requirements

4.1 General Requirements

4.1.1 Yarn

4.1.1.1 Monofilament yarn shall be manufactured from HDPE granules, which shall be UV stabilized by adding suitable UV stabilizer. The linear density ofthe monofilament yarn used for the manufacture of windshield nets be as specified in Table 1.

4.1.1.2 The heat shrinkage of the monofilament yarn at 60°C and 95°C shall be as specified

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in Table 1.

4.1.2 Fabric

The fabric used in the manufacture of windshield nets shall be knitted on the warp knitting machines and shall have a width as per the agreement between the buyer and the seller.

4.1.3 Eyelet

4.1.3.1 Eyelets shall be provided during knitting along the width of the net after every 1 m length or as agreed between the buyer and the seller. Length of the eyelet shall be 20 ± 5 mm. Eyelet to eyelet edge distance across the width of the net shall be 45 ± 5 mm or as agreed between the buyer and the seller. The line diagram showing the location of eyelets across width and length of the fabric is shown in Fig. 1.

4.1.3.2 For reinforcement of the eyelets, minimum doubleyarn in the warp (course) shall be used in minimum 3 pillars on both sides of eyelet.

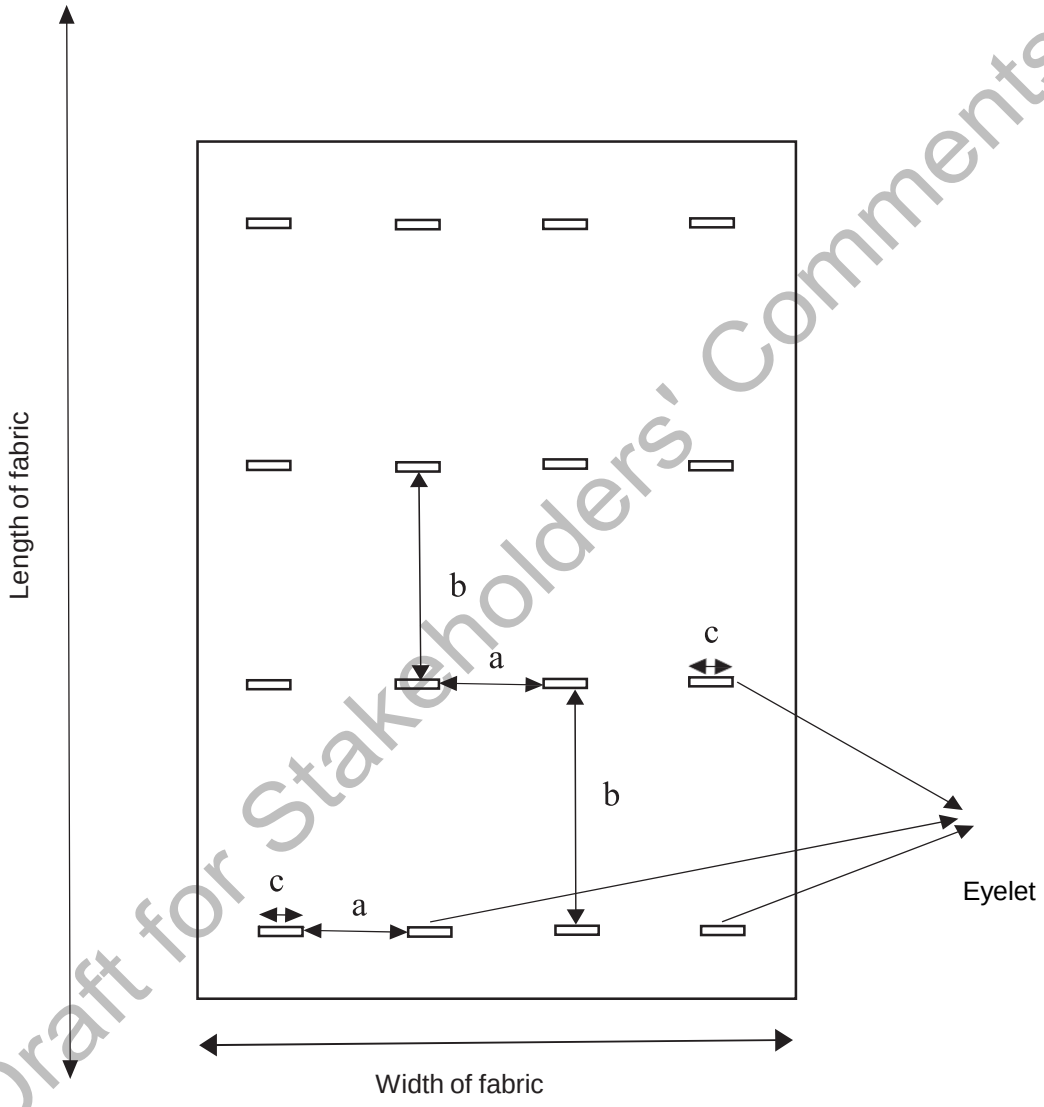

Figure: 1 Location of eyelets across width and length of the fabric

a = eyelet edge to edge distance across the width of fabric

b = eyelet to eyelet distance across the length of fabric

c = length of eyelet, across the width of the fabric

4.1.4 Color

The color or a mixture of color of the windshield nets fabric shall be as per the agreement between the buyer and the seller. The color/shade shall be as specified in the contract or order.

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4.1.5 Types of the windshield nets

Based on the mass in g/m^2, the windshield nets are classified as follows:

a) Type I – having mass of 100 g/m^2, Min., suitable for wind speed up to 55 km/h

b) Type II – having mass of 150 g/m^2, Min., suitable for wind speed up to 80 km/h

4.2 Specific requirement

4.2.1 The windshield nets fabric shall conform to the requirements specified in Table 1.

4.2.2 The windshield nets shall be made to the shade and dimensions as specified in the contract or order. The dimensions shall be determined by the method prescribed in TZS 3116. The following tolerance shall be permissible for length and width.

Dimension	*Tolerance, percent*
Length	± 1 percent of declared length
Width	±1 percent of declared width

Table 1: Requirements of windshield nets made from monofilament yarns

S/N	Characteristics	Requirements		Test Methods
		Type 1	Type 2	
1.	Mass g/m^2 , *Min*	100	150	TZS 21
2.	Breaking strength N, *Min*; a) Warp way b) Weft way	350 350	400 700	TZS 22
3.	Retention of breaking strength after UV exposure of 144 h, percent, *Min*	85 percent of original actual value (fabric)		Annex A
4.	Linear density, Denier, Min	320		TZS 262
5.	Shrinkage temperature[1], a) At 60°C b) At 95°C	≤5% ≤8%		Annex C
6.	Color fastness to artificial light,Min.	4		ISO 105-B02
7.	Bursting pressure, kgf/cm^2, *Min*	10	14	TZS 4455-1/ISO 13938-1
8.	Wind blockage, percent, *Min*	18	35	Annex B

Note 1: For determining the shrinkage, the tape shall be subjected to the specified temperature for a period of 10 min in an air circulating oven and hot water bath respectively.

5. Packaging, Marking and Labelling

5.1 Packaging

5.1.1 The windshield nets shall be packed in rolls or bundles.

5.1.2 Each roll/bundle shall be protected by wrapping it in a suitable material to prevent it from the adverse impact of heat and moisture, oil, grease, dirt, dust and other stains during shipment and storage prior to use.

5.2 **Marking and labelling**

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The windshield net fabric roll/bundle shall be marked or labelled legibly with the following information:

a) Name of the product;
b) Country of origin;
c) Manufacturer’s name and address;
d) Declared length, width, color, GSM and
e) Batch number.

6. Sampling

Sampling shall be done in accordance with ISO 2859-1.

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ANNEX A

UV RESISTANCE TEST

A-1 TEST SPECIMENS

The test specimens for breaking strength shall be cut from the sample as specified in TZS 22.

A-2 TEST CONDITIONS

A-2.1 The test shall be carried out with fluorescent UV-B lamp (313 nanometer or its equivalent).

A-2.2 The duration of the test shall be 144 h (that is 6 days).

A-2.3 The test cycle shall be 8 h at 60 ± 3 °C withUV radiation alternating after 4 h at 50 ± 3° C with condensation.

A-2.4 Irradiation level throughout the test shall be maintained at 0.63 ±0.03 W/m².

A-3 TEST PROCEDURE

A-3.1 Determine the original average breaking strengthof windshield nets specimens separately as per the test specified in ISO 13934-2**.**

A-3.2 Expose the specimens alternately to ultraviolet light alone and to condensation in one respective cycle.

A-3.2.1 The type of fluorescent UV lamp, the timing ofthe UV exposure and the temperature of condensation shall be as specified in **A-2**.

A-3.3 Determine the average breaking strength of the specimens separately after UV exposure as mentioned above.

A-3.4 Determine the percent retention of original strength as follows:

$$\textit{Percent retention of original breaking strength} = \frac{b}{a} \times \mathbf{100}$$

Where:

a = average breaking strength before UV exposure as obtained in **A-3.1**, and
b = average breaking strength after UV exposures obtained in **A-3.3**.

NOTES:

1. The UV source is an array of fluorescent lamps (with lamp emission concentrated in the UV range).

2. Condensation is produced by exposing the test surface to a heated, saturated mixture of air and water vapor, while the reverse side of the test specimen is exposed to the cooling influence of ambient room air.

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ANNEX B

DETERMINATION OF WIND BLOCKAGE (PERCENT)

B-1 PRINCIPLE

This instrumental set up helps in determining the value of wind blockage based on the relative measurement.It consists of a wind source generated with pressure arrangement under the controlled temperature and humidity conditions. A chamber has been designed with arrangement for proper placement of wind source,sample holders for holding the windshield net sample and the anemometer as wind measuring source. The wind velocity passed with and without the sample is measured by anemometer (in km/h that is kilometer perhour) and accordingly the wind blockage percentageis calculated. The test shall be performed in closed chamber.

B-2 SAMPLING

B-2.1 Laboratory Sample

For the laboratory sample take a swatch extending the full width of the product, of sufficient length alongthe selvage from each sample roll/bundle so that the requirements of **B-2.2** can be met.

B-2.2 Test Specimens

From the laboratory sample, cut at least 10 samples each having dimensions of 200 × 200 mm. Space the specimens along a diagonal on the unit of the laboratorysample. Take no specimens nearer the selvage or edge of the shade nets. The selected test specimens shall nothave any creases or folds.

B-3 CONDITIONING

Bring the specimens to moisture equilibrium in the atmosphere for testing windshield nets (65 ± 5 percent relative humidity and 27 ± 2°C temperature). Equilibrium is considered to have been reached when the increase in the mass of the specimen, in successive weightings made at intervals of not less than 2 h, does not exceed 0.1 percent of the mass of the specimen.

B-4 APPARATUS

B-4.1 General

Instrument is based on principle given in **B-1**.

B-4.2 The apparatus consists of the following parts:

B-4.2.1 *Source of Wind* **—** Blower/compressed air with velocity range of 30 km/h to 180 km/h.

B-4.2.2 *Measurement Chamber* **—** Cylindrical with diameter of 160 mm.

B-4.2.3 *Clamping Device* **—** Sample holder.

B-4.2.4 Sensing probes will be used in alignment with the source (stationary mode).

B-4.2.5 *Measurement of Wind Energy* **—** By anemometer

B-5 TEST PROCEDURE

B-5.1 For type 1 wind shield nets, wind blockage test shall be carried out at wind velocity of 55 km/h and for type 2 wind shield nets, wind blockage test shall be carried out at wind velocity of 80 km/h.

B-5.2 Put on the wind source and measure wind speed passed through the sample holder without sample with the help of anemometer and record as w1. Hence, w1 is the reading of wind velocity without sample.

B-5.3 Then mount the sample on the sample holder and insert the sample holder in the slot. Put on the wind source to measure the wind speed with the help of anemometer and record it as w2. Thus, w2 is reading with sample.

B-5.4 Calculate the wind blockage percentage with the following formula:

$$\textit{Wind blockage, percent} = \frac{W1-W2}{W1} \times 100$$

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Where,

W1= Reading of wind velocity, in km/h (without sample); and
W2= Reading of wind velocity, in km/h (with sample).

B-5.5 Repeat the procedure for other 9 samples as specified in B-5.2 to B-5.4.

B-5.6 Take average of all 10 readings.

ANNEX C
DIMENSIONAL STABILITY

C.1 OBJECT

To determine the dimensional stability of woven ground covers for horticulture application.

C.2 APPARATUS

C.2.1 A circulating air oven having thermostatic control that will maintain a temperature of 60 ± 2°C and 95 ± 2°C and equipped with horizontal rigid metal plates or wired shelves for supporting the test piece. The shelves shall be at least 25mrn larger than the test piece in each direction.

C.2.2 A travelling microscope or suitable scale capable of measuring to an accuracy of 0·01 mm.

C.2.3 A steel plate 180 x 180 mm and 12.5 mm thick for keeping the test piece flat during measurement.

C.3 TEST SPECIMEN

Test specimen shall not be less than 200 X 200 mm. Three sets of equally spaced reference marks shall be marked along each linear dimensions of the surface of the test specimen, the marks in each set being 180 mm apart (see Figure 3). Two test specimens shall be tested.

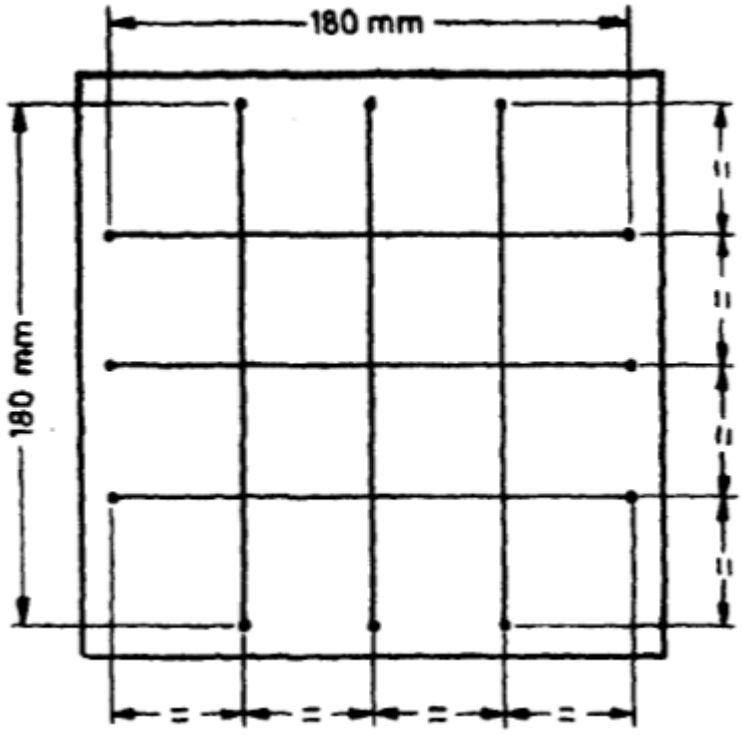

Figure 3: Reference marks on test specimen

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C.4 PROCEDURE

Immediately after conditioning as given in 2, the test specimen shall be placed on a perfectly flat surface with the 12.5 mm thick steel plate on top of it, and the distance between each pair of marks shall be measured to the nearest 0.01 mm. The steel plate shall then be removed and test specimen shall be placed horizontally on one of the shelves of the oven, with its wearing surface upwards and maintained at a temperature of 60 ± 2°C and 95 ± 2°C for six hours. The test piece shall then be removed from the oven allowed to cool to room temperature and then shall again be conditioned as given in 2. The distance between each pair of reference marks shall then be measured.

C.5 REPORT

Any change in the distance between each pair of marks shall be calculated as a percentage of the original distance and the average value of the changes in the distance of the three pairs of marks in each linear direction shall be reported as the dimensional stability in that direction,

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ANNEX D

(Informative)

GUIDELINES FOR INSTALLATION OF WINDSHIELD NETS

D-1 PREAMBLE

D-1.1 The primary function of windshield net applied in agriculture and horticulture applications is protection of crop from high speed wind. The durability of windshield net is based on a good quality material and proper installation technique.

D-1.2 There are number of fabrics specifically produced for windshields. The longest lasting and most resilient are knitted from monofilament yarn and have wind porosity at least 50 percent.

D-1.3 To improve the service of windshield nets, it is essential that the windshield nets are placed on suitable structures according to the dimensions. To achieve this proper onsite laying, joining and fixing of windshield net is imperative.

D-2 LOGISTICS

Windshield nets are packed in roll form/bundle form with suitable packing material and transported by appropriate means to protect the windshield nets and avoid any type of damage. Rolls of windshield nets are loaded manually or with forklift and can be unloaded in a similar manner at the destination. Use of hooks shall be avoided for loading and unloading of the rolls of windshield nets at site.

D-3 STORAGE AT SITE

D-3.1 The windshield nets shall be stored so as to be protected from damage, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or any other damage. The rolls/bundles shall be stored on a prepared surface and to be stacked not more than three rolls/ bundles.

D-3.2 The owner of the site where the windshield net is to be installed shall provide storage space in a location sufficiently near the windshield net structure to minimize any additional handling.

D-3.3 The storage area shall be protected from theft, vandalism, vehicular traffic and any other source which could create potential damage to the windshield nets.

D-4 PLANNING FOR WINDSHIELD INSTALLATION

D-4.1 The windshield structure should be planned taking into consideration the type of crop to be grown, locally available materials and the finance budget and local climatic conditions. The provision should be there for future expansion.

D-4.2 Ideally, a windshield net should be at right angles to the prevailing wind. Note that there will be areas of high wind speed and turbulence around the ends of a windshield fence, so the fence should

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always be longer than the area requiring protection or it should have sides. It's recommended that windshields net should not be less than 11 times as long as they are high for best effect. For example, 5 m high windshield should be at least (5 × 11) 55m long.

D-5 SITE CONSIDERATIONS

Windshield should be installed in high speed wind affected areas to protect the crops from wind damage. The zone of protection on the down-wind side of the windshield will be 6 to 8 times the fence height. This distance of protection will be less if the ground rises on the down-wind side and will be more if the ground drops away. When calculating the required height or distance between windshield fences, consideration must be given to the crop height.

Zone of protection = (Actual windshield height – crop height) × 6

D-6 STRUCTURAL MATERIALS

D-6.1 Support posts

Timber posts are normally used because of availability and ease of use. Tapered hardwood or pine of an appropriate diameter is most suitable. Generally speaking, shaved pine posts or sawn hardwood are not suitable. Steel posts can also be used but present some difficulties in attaching cables and cloth. When selecting posts, it is the strength at ground level which is the most important factor. Line diagram for installation of wind shield nets is shown in Fig. 3.

D-6.2 Wire and cable

Wire or cable is used to support the cloth and transfer the loads to the posts. In the more traditional forms of construction where posts are less than 8 meters apart, single strand wire is used. 3.15 mm high tensile (HT wire) is used to support the top and bottom edges and 2.5mm HT wire is suitable as intermediate wires (anti- billow wires). Ultra-long span (ULS) construction methods use wider post spacing and fewer wires. Multi strand high tensile cables are used on top and bottom edges of the cloth to support higher wind loadings.

D-6.3 Construction

The distance between posts depends on several factors but is commonly 6 to 8 meters. For cantilever pole construction, post embedment depth is a critical factor. In general posts should have 30-40 percent of their height in the ground. The following situations would require greater depths of post embedment:

a) Weak, sandy or wet soils;
b) Areas of higher than normal wind speeds;
c) Wider post spacing;
d) Greater windshield heights;
e) Undulating topography (higher wind speeds); and
f) Lower porosity windshield cloth.

The erector should not ignore the wind loading on posts. For example, for a 4.5 m high fence with a 6 m post spacing, a 20 m/s wind would give each post a loading of 0.54 tones. At 30 m/s wind speed the post loading goes up to 1.2 tones. If post strength is doubtful or adequate embedment depths cannot be achieved, then an option is to install an anchored guy on each post that is brace each post with a cable from the top of the post to an anchor in the ground. Guy-wires can restrict access but this system allows

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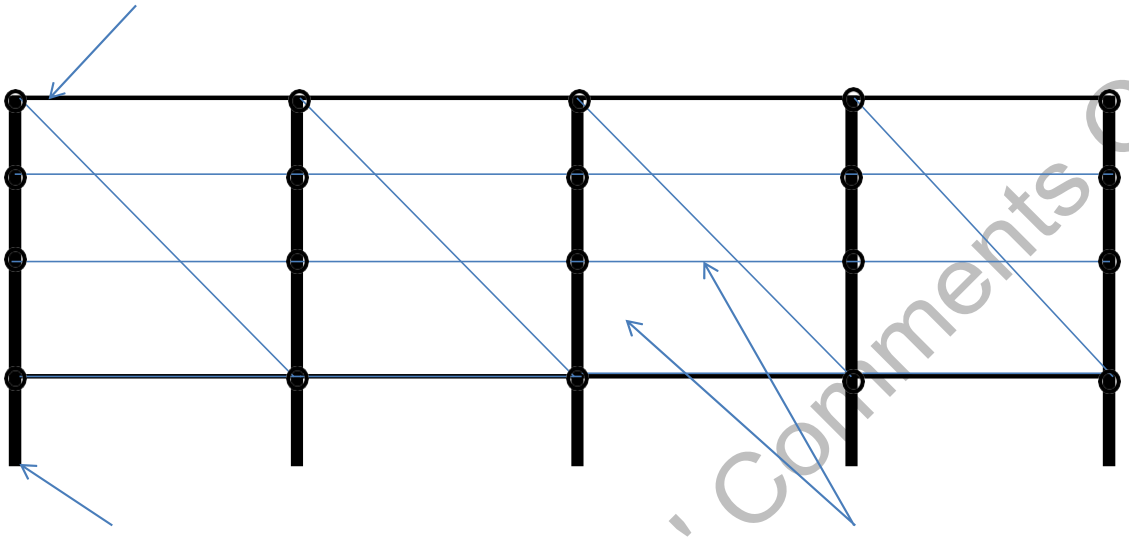
the use of smaller poles and shallower embedment.

Windbreak net with eyelets



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