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EVALUATING THE PERFORMANCE OF AGRO-TEXTILES CAPABLE OF ECONOMIZING IRRIGATION WATER AND FERTILIZERS

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ABSTRACT

Textile products are playing very vital role in agriculture. The main purpose of this study was to produce nonwoven waste fabrics which are considered one of the Agro-Textile capable of providing irrigation water and fertilizers.

Non woven technique was applied to produce 15 samples by using five different weights and three needle penetration depth. The results demonstrated that the best sample able to provide water for irrigation, and converted to compost after its decomposition is the biggest weight.

***Keywords:* Agro-Textiles, Absorbency, Decomposition, Economizing, Fertilizers, Irrigation Water and Nonwoven Waste Fabrics.**

I INTRODUCTION

Textiles used in Agriculture are termed as AGRO-TEXTILES. The reduced usage of harmful pesticides and herbicides render a healthy farming culture and is an eco-friendly technique. Agricultural textiles for its excellent environmental resistance, mechanical properties, easy process ability and durability characteristics can improve quantity, quality and safety of agricultural products **[1].**

1.1. Advantages of Textiles Used In Agriculture

- Increase Crop Production.
- Avoid The Soil From Drying Out.
- Decrease the Requirement of Fertilizers, Pesticides and Water.
- Make Product Quality Better.
- Increase the Early Maturing Of Crops and Non-Seasonal Plants.
- Protects from climatic changes and its effect. **[1]**

1.2. Raw Material Used For Manufacturing of Agro-Textile Products:

Man made fibers are preferred for many agricultural end uses than natural fibers mainly due to their favorable price/ performance ratio, ease of transport and setting up, space saving storage and long service life. Synthetic fibers like polypropylene, polyethylene, polyester and widely used. **[2]**

Natural fibers, like jute, coir, sisal, etc. have quite a few inherent properties suited to meet the requirements of different types of geo-Textiles. Shorter durability of natural geo-Textiles is a matter of apparent concern of end-users in general, though their eco-compatibility gives them an edge over man-made geo-textiles. **[3]**

Geo-Textiles made of natural fibers like jute (JGT) have been found to be effective in improving geotechnical characteristics of soil, it is a natural, eco-friendly, biodegradable and annually renewable baste fiber. The enormous potential of jute geo-textile is being increasingly appreciated by end-users because of its low price and technical feasibility. JGT can retain almost 5 times their own weight of moisture, prevent dehydration of soil, allow air and light through their open structures and provide nutrients to the soil after their biodegradation. One of the most important weaknesses of the jute products are their quick biodegradability, but their life span can extended even up to 20 years through different treatments and blending. [**4, 5, 6, 7, 8, 9**]

1.3. Different Method of Agro-Textile Production

Several techniques of fabric production can be used to produce agro-textiles as:

1.3.1. Weaving: The range of light to heavy and wide width fabric production is possible. **[1, 10, 11].**

1.3.2. Knitting: Warp knitting technique is most widely used in comparison to weft knitting. **[1, 10, 11]**

1.3.3. Nonwoven: Non-woven fabrics provide specific functions such as absorbency, liquid repellency, resilience, stretch, filtering, bacterial barrier and sterility. These properties are often combined to create fabrics suited for specific applications, while achieving a good balance between product use-life and cost. **[12]**

Nonwovens are used effectively for optimizing the productivity of crop. Their protective nature means that the need for pesticides is reduced and manual labor is kept to a minimum. The use of nonwoven crop covers on the land increases yields and improves the quality of the crops. **[12]**

1.4. Applications of agro textiles: [1, 10]

1.4.1. Sunscreen: These are used in order to protect fields from the intense solar radiation for healthy plant growth and good harvest.

1.4.2. Bird protection nets: Knitted monofilament nets offer effective passive protection of seeds, crops and fruit against damage caused by birds.

1.4.3. 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.

1.4.4. Ground cover: It effectively suppressed competitive weed growth, conserves ground moisture, maintains a clean surface, protects from UV rays and creates a favorable environment for healthy plant growth.

1.4.5. Windshield: Windshields are used in farming to protect fruit plantations from wind and to prevent damage to plants.

1.4.6. **Root ball net:** It is extremely important for safe and speedy growing of young plants such that root system is not damaged when they are dug up, transported or replanted.

1.4.7. **Insect meshes:** woven and knitted polyethylene monofilament meshes to exclude harmful insects from greenhouses and tunnels, or to keep pollinating insects inside.

1.4.8. **Mulch mat:** they are used to suppress weed growth in horticulture applications, It covers the soil, blocking of light and preventing the competitive wheat growth around seed.

1.4.9. **Cold and frost control fabrics:** The can be laid directly on the plants. These fabrics protect the plant from frost kill during unexpected late cold snaps.

1.4.10. **Nets for covering pallets:** For safe transportation of fruits and vegetables to the market the boxes are covered with large mesh nets.

1.4.11. **Packing materials for agricultural products:** Nets can be used for packaging of farm products for many end uses.

1.4.12. **Moisturizers:** Moisturizers are generally from natural Fibers. They are fabricated and design so that they have high water holding capacity. High capillarity and hydrogen bonding properties are special properties for these types of geo-Textiles, so that they can provide water to the plants/crops/land/structure when needed. It is necessary to increase the yield and quality of agro-products within the space and water constraints we are faced with today. Important characteristics and functions of these types of geo-Textiles are to perform:

- Water holding, storing and discharging capacity.
- Protecting soil moisture for facilitating the germination of seed.
- Protecting soil moisture form evaporation and holding heat of the soil facilitating the germination of seed.
- Siphoning water according to the need of plant.
- Facilitating the growth of useful soil microbes.
- To protect plant from cold/wilting effect.

The high initial water content of the soil indicated that the soil was very soft. Water content decreased after the laying of geo-Textiles over a period of time, indicating the increase in the effective stress. The reduction in water content, increase in effective stress and decrease in dry density show that, following introduction of jute geo-textile, water was drained out of the soil, indicating that the geo-textile served as a drainage medium also. **[11,13]**

1.5. Properties Required For Agro-Textile Products

The essential properties required for agro-textile are:

- Tensile strength.
- Resistance to solar radiation.
- Resistance to ultraviolet radiation.

- Abrasion Resistance stiffness, and bio-degradation.
- Resistance to toxic environment.
- High potential to retain water.
- Protection property.
- Resistance to microorganisms.
- Stable construction.
- Lightweight**. [1, 10, 14]**

II EXPERIMENTAL WORK

2.1. Specification of samples under study

The present research is concerned with the nonwoven waste fabrics which are the considered one of the Agro-Textile capable of providing irrigation water and fertilizers. Non woven Technique was applied to produce 15 samples by using five different weights and three needle penetration depth.

Table (1) specification of nonwoven waste Fabrics

No.	Property	Specification
1	Fiber Type	Waste (50% jute , 25% cotton, 25% polyester + polypropylene)
2	Fiber length	20, 30, 40 mm
3	Fiber count	3, 6, 15, 25 den.
4	Web formation	C.L. (cross- laid)
5	Fabric weight	600 – 750 – 1250 – 1360 -1500 gm/ m^2
6	Beats/min	250
7	Needle penetration.	9 – 11 and 13 mm

2.2. Test applied to samples under study

The experimental tests have been achieved in the weave laboratory in the National Institute for standards in Harm Giza and laboratory of sails, water & Environment Res. In a standard environment (relative moisture: 65+2, Temperature 20^{o}C + 2).

In order to evaluate the performance properties of the produced samples, the following tests were carried out:

1- Tensile strength and elongation at break in both directions was determined according with (ASTM-D 4595-83) by using Tensile Testing Machine Tinius Olsen- SDLATLATLAS Model H5KT.

2- Fabric air permeability measurements in accordance (ASTM-D 737) using TEXTESTFX 3300 air permeability tester at a pressure of 120 pas.

3- Fabric absorptive capacity and absorbency time was determined accordance with (ASTM-D1117-80).

4- The ability to retain water was determined according with (ASTM D 3776/D3776M-og a standard test Methods for mass per unit Area (weight) of fabric.

5- Fabric thickness, this test was carried out according to the ASTM-D1777-1996.

6- Fabric weight, this test was carried out according to the ASTM-D3776-1979.

7- Sample analysis (decomposition):

a) Total carbon was estimated according to sarah (2011)

b) Total Nitrogen was determined by Kjeldahel Technique Jackson (1973).

8- Total content of heavy metals in samples (3) were determined by inductively coupled plasma spectrometry (ICP) (ultimate 2JY plasma).

III RESULTS AND DISCUSSION

Results of the experimental tests carried out on samples under study are presented in the following tables and graphs. Results were also statistically analyzed for data listed and relationships between variables were obtained.

Table (2) Results of the experimental tests which carried out on samples under study at needles penetration depth (9mm)

No.	Weight gm/m^2	Length tensile strength kg/cm^2	width tensile strength kg/cm^2	length elongation %	width elongation %	air permeability cm^3/cm^2/sec	Absorb%	Thickness mm
1	600	12.43	9.26	21.92	12.9	78.44	470.23	5.12
2	750	13.67	9.84	22.69	14.67	64.91	588.36	6.92
3	1250	20.58	16.87	25.28	19.93	41.52	750.53	9.15
4	1360	25.72	21.88	32.62	20.81	39.05	816.82	13.14
5	1500	31.65	24.75	19.5	16.18	36.68	900.31	15.22

Table (3) Results of the experimental tests which carried out on samples under study at needles penetration depth (11mm)

No.	Weight gm/m^2	Length tensile strength kg/cm^2	width tensile strength kg/cm^2	length elongation %	width elongation %	air permeability cm^3/cm^2/sec	Absorb%	Thickness mm
1	600	13.46	10.53	22.76	13.79	73.82	453.74	4.83
2	750	14.78	10.93	23.51	15.87	61.09	567.92	6.53
3	1250	22.17	19.23	26.19	21.23	39.07	727.63	8.64
4	1360	27.28	23.04	33.78	22.24	36.75	791.94	12.41
5	1500	33.15	26.08	20.3	17.28	34.71	872.82	14.48

Table (4) Results of the experimental tests which carried out on samples under study at needles penetration depth (13mm)

No.	Weight gm/m^2	Length tensile strength kg/cm^2	width tensile strength kg/cm^2	length elongation %	width elongation %	air permeability cm^3/cm^2/sec	Absorb%	Thickness mm
1	600	14.44	11.72	23.54	14.58	68.95	437.94	4.51
2	750	15.89	12.15	24.37	16.56	57.02	548.27	6.08
3	1250	23.94	21.42	27.16	22.67	36.44	705.48	8.06
4	1360	28.87	25.78	35.03	23.46	34.28	767.76	11.76
5	1500	35.64	28.84	22.08	18.27	32.37	846.25	13.67

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3.1. Effect of research variables on fabric tensile strength at break:

Table (5) Tensile strength measurements results in both directions

Tensile strength kg/cm^2											
Weight		600 gm/m^2		750 gm/m^2		1250 gm/m^2		1360 gm/m^2		1500 gm/m^2	
Direction		Length	Width	Length	Width	Length	Width	Length	Width	Length	width
Needles Penetration Mm	9	12.43	9.26	13.67	9.84	20.58	16.87	25.72	21.88	31.65	24.75
	11	13.46	10.53	14.78	10.93	22.17	19.23	27.28	23.04	33.15	26.08
	13	14.44	11.72	15.89	12.15	23.94	21.42	28.87	25.78	35.64	28.84

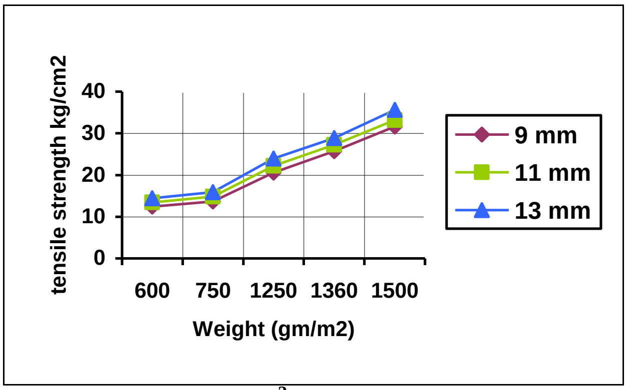

Fig. (1) Effect of weight (gm/m^2) on length tensile strength (kg/cm^2)

Table (6) regression equation and correlation coefficient for the effect of weight g/m^2 on length tensile strength of fabric at needle penetration depth 9, 11, 13 mm.

Needle penetration depth	Regression equation	Correlation coefficient
9 mm	Y = 0.0197132 X – 0.716761	0.9591
11 mm	Y = 0.0203478 X – 0.051783	0.9642
13 mm	Y = 0.0217297 X + 0.0271986	0.9642

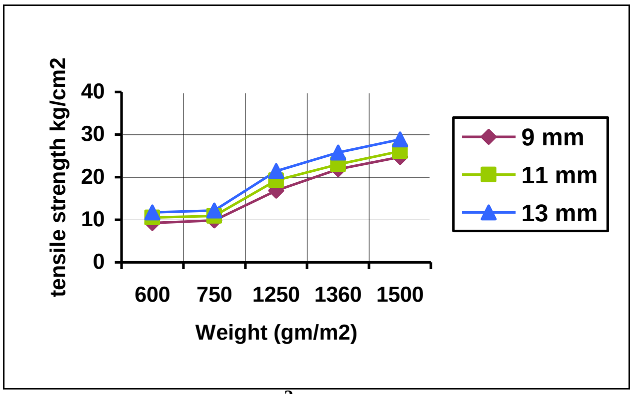

Fig. (2) Effect of weight (gm/m^2) on width tensile strength (kg/cm^2)

Table (7) regression equation and correlation coefficient for the effect of weight g/m^2 on width tensile strength of fabric at needle penetration depth 9, 11, 13 mm.

Needle penetration depth	Regression equation	Correlation coefficient
9mm	Y = 0.0172046 X – 2.26746	0.9746
11mm	Y = 0.0175723 X – 1.22693	0.9852
13mm	Y = 0.0195066 X – 1.31923	0.9856

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It is clear from table (5) and fig. (1 and 2) that, there is a direct relationship between fabrics weight and its tensile strength. This is for the sake of that; the increase in weight means increase of fibers per unit area leading to the increase in fabrics tensile strength in both directions.

It can also be seen from the results that, there is extrusive relationship between the depth of needles penetration and fabrics tensile strength (in both direction).

This is due to that punching technique decreases spaces between fibers to be more compacted and increase in tensile strength.

3.2. Effect of Research Variables on Fabric Elongation at Break

Table (8) Fabric elongation at break measurements results in both direction

Elongation at break %											
Weight		600 gm/m^2		750 gm/m^2		1250 gm/m^2		1360 gm/m^2		1500 gm/m^2	
Direction		Length	Width	Length	Width	Length	Width	Length	Width	Length	width
Needles	9	21.92	12.9	22.69	14.67	25.28	19.93	32.62	20.81	19.5	16.18
Penetration	11	22.76	13.79	23.51	15.87	26.19	21.23	33.78	22.24	20.30	17.28
Mm	13	23.54	14.58	24.73	16.56	27.16	22.67	35.03	23.46	22.08	18.27

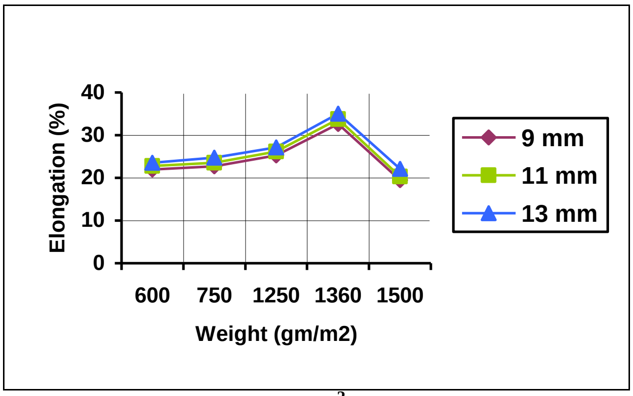

Fig. (3) Effect of weight (gm/m^2) on length elongation (%)

Table (9) regression equation and correlation coefficient for the effect of weight g/m^2 on length elongation of fabric at needle penetration depth 9, 11, 13

Needle penetration depth	Regression equation	Correlation coefficient
9mm	Y = 0.00345147 X + 20.633	0.2703
11mm	Y = 0.00359182 X + 21.3857	0.2735
13mm	Y = 0.00425631 X + 21.8601	0.3282

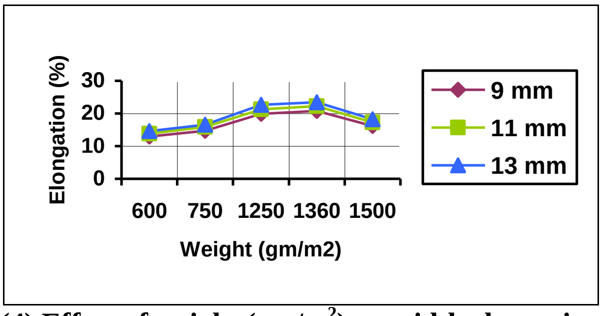

Fig. (4) Effect of weight (gm/m^2) on width elongation (%)

Table (10) regression equation and correlation coefficient for the effect of weight g/m^2 on width elongation of fabric at needle penetration depth, 9, 11, 13 mm.

Needle penetration depth	Regression equation	Correlation coefficient
9mm	Y = 0.00636935 X + 9.94267	0.7411
11mm	Y = 0.00667333 X + 10.7947	0.7360
13mm	Y = 0.00720965 X + 11.2351	0.7384

Table (8), and fig. (3) show that, there is a direct relationship between the fabrics weight and its elongation in both direction , where the increase in weight means increase in elongation, this is due to the increase fiber density per unit, unless last fabric (15000 g/m^2), its elongation decrease where weight are equal.

3.3. Effect of research variables on fabric air permeability:

Table (11) Fabric air permeability measurements results

Fabric air permeability cm^3/cm^2/sec						
Weight		600 gm/m^2	750 gm/m^2	1250 gm/m^2	1360 gm/m^2	1500 gm/m^2
Needles penetration depth mm (Two sides)	9	78.44	64.91	41.52	39.05	36.68
	11	73.82	61.09	39.07	36.75	34.71
	13	68.95	57.02	36.44	34.28	32.37

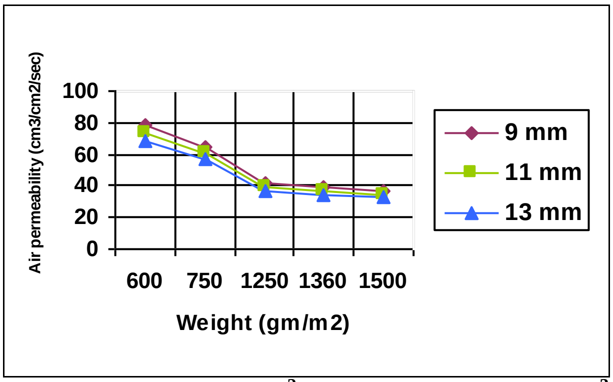

Fig. (5) Effect of weight (gm/m^2) on air permeability cm^3/cm^2/sec

Table (12) regression equation and correlation coefficient for the effect of weight g/m^2 on fabric air permeability at needle penetration depth 9, 11, 13mm.

Needle penetration depth	Regression equation	Correlation coefficient
9mm	Y = – 0.0462825 X + 102.661	– 0.9836
11mm	Y = – 0.0434346 X + 96.5186	– 0.9830
13mm	Y = – 0.0406131 X + 90.1615	– 0.9829

It is obvious from table (11) and fig. (5) that, there is an inverse relationship between fabrics weight and its air permeability, where increase of fabrics weight accompanied with decrease of air permeability, because increase in weight means increase in number of fibers per unit area and decrease of space between fibers causing an obstruction in air passage leading to the decrease in air permeability.

It was also found from table (11) and fig. (5) That the more needles penetration depth the less air permeability of fabrics. That is because, the increase of needles, penetration depth means decrease of space between fibers, so the air permeability decrease and it's became more compact.

3.4. Effect of research variables on fabric thickness

Table (13): Fabric thickness measurements results

Fabric thickness (mm)						
Weight		600 gm/m^2	750 gm/m^2	1250 gm/m^2	1360 gm/m^2	1500 gm/m^2
Needles penetration depth mm (Two sides)	9	5.12	6.92	9.15	13.14	15.22
	11	4.83	6.53	8.64	12.41	14.48
	13	4.51	6.08	8.06	11.76	13.67

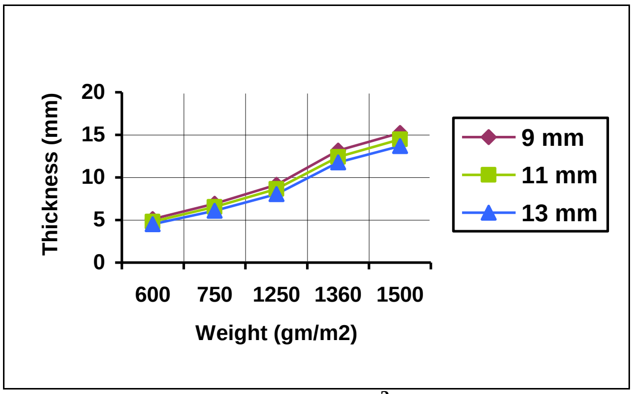

Fig. (6) Effect of weight (gm/m^2) on thickness (mm)

Table (14) regression equation and correlation coefficient for the effect of weight g/m^2 on fabric thickness at needle penetration depth 9, 11, 13 mm.

Needle penetration depth	Regression equation	Correlation coefficient
9mm	Y = 0.0101101 X – 1.13021	0.9459
11mm	Y = 0.00962464 X – 1.1321	0.9449
13mm	Y = 0.00916668 X – 1.19401	0.9428

It is obvious from table (13) and fig. (6) that, there is a direct relationship between fabrics weight and its thickness. This is for the sake of that; the increase in weight means increase in number of fibers per unit area leading to the increase in fabrics thickness. Results also show that, there is an inverse relationship between needle penetration depth and fabric thickness as by increase needle penetration depth the thickness of fabric decreases. This is due to that punching technique decreases spaces between fibers leading to fabric to be more compacted and decrease its thickness.

3.5. Effect of research variables on fabric absorbency:

Table (15) fabric absorptive capacity and absorbency time measurement results

Absorbency % (at 10 sec.)						
Weight		600 gm/m^2	750 gm/m^2	1250 gm/m^2	1360 gm/m^2	1500 gm/m^2
Needles penetration depth mm	9	470.23	588.36	750.53	816.82	900.31
	11	453.74	567.92	727.63	791.94	872.82
	13	437.94	548.27	705.48	767.76	846.25

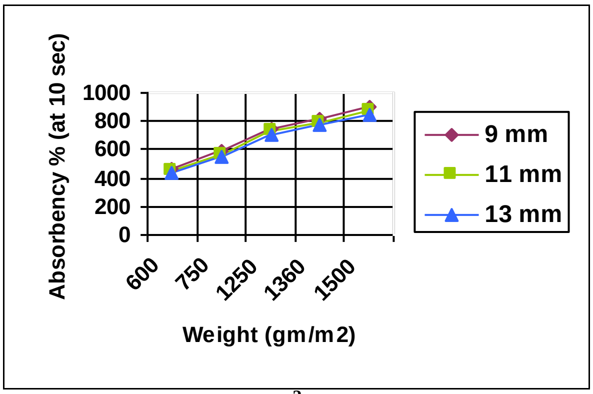

Fig. (7) Effect of weight (gm/m^2) on Absorbency % (at 10 sec.)

Table (16) regression equation and correlation coefficient for the effect of weight g/m^2 on fabric absorbency at needle penetration depth 9, 11, 13 mm.

Needle penetration depth	Regression equation	Correlation coefficient
9mm	Y = 0.437497 X + 227.503	0.9903
11mm	Y = 0.427215 X + 216.291	0.9908
13mm	Y = 0.417048 X + 205.723	0.9912

It can be seen from table (15) and fig. (7) That the increase of fabrics weight correlated with increase fabric absorbency, because increase in fabrics weight means increase the fibers per unit area (jute and cotton) which can absorb a lot of water so absorbency was increase.

It can be also noticed from table (15) and fig. (7) That the more needles penetration depth leading to lower absorbency, this is mainly due to that the increases in needles penetration increase the contact areas between fibers and decrease void spaces, which decrease the passage of water.

3.6. Effect of research variables on fabrics ability to retain water with time:-

Table (17) Fabric ability to retain water with time measurements results at 600gm/m^2

Ability to retain water with time %								
Weight		600 gm/m^2						
Time with hour		1	10	24	48	72	96	120
Needle penetration depth	9	92.8	87.7	69.2	49.2	30.2	13.7	1.3
	11	91.2	85.8	67.8	47.8	28.2	11.8	0.7
	13	90.7	83.7	66.2	46.2	27.8	10.7	0.2

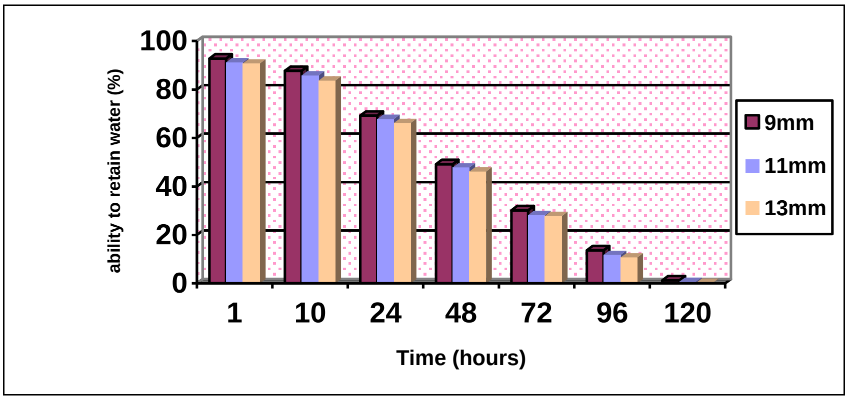

Fig. (8) Effect of needle penetration depth and time on ability to retain water at 600 gm/m^2

Table (18) Fabric ability to retain water with time measurements results at 750 gm/m²

Ability to retain water with time %									
Weight		750 gm/m²							
Time with hour		1	10	24	48	72	96	120	144
Needle penetration depth	9	95.6	84.2	68.6	45.2	28.5	16.2	8.4	1.3
	11	94.2	82.7	67.4	43.8	27	14.8	7.7	0.8
	13	93.5	81.7	66.2	42.5	26.8	13.7	5.2	0.2

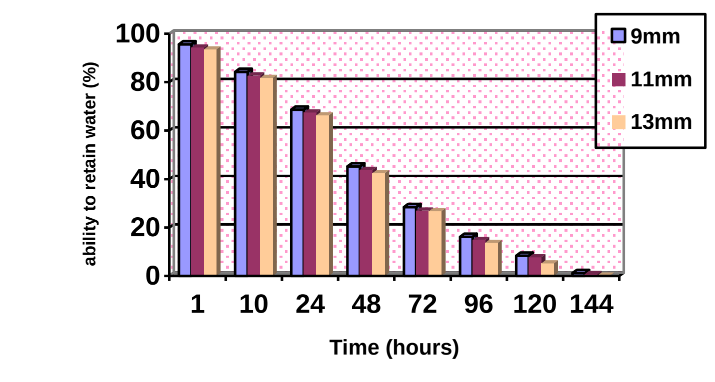

Fig. (9) Effect of needle penetration depth and time on ability to retain water at 750 gm/m²

Table (19) Fabric ability to retain water with time measurements results at 1250 gm/m²

Ability to retain water with time %										
Weight		1250 gm/m²								
Time with hour		1	10	24	48	72	96	120	144	168
Needle penetration depth	9	97.1	88.5	80.3	59.6	42.7	29.5	19.8	10.7	1.2
	11	96.3	87.2	79.1	57.8	40.8	28.2	18.5	9.1	0.6
	13	95.1	85.5	78.3	56.6	39.7	26.8	17.9	7.8	0.1

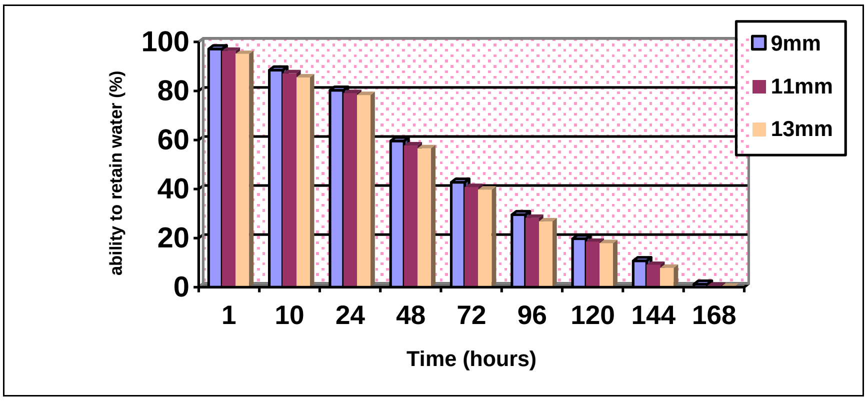

Fig. (10) Effect of needle penetration depth and time on ability to retain water at 1250 gm/m²

Table (20) Fabric ability to retain water with time measurements results at 1360 gm/m²

Ability to retain water with time %

Weight		1360gm/m²										
Time with hour		1	10	24	48	72	96	120	144	168	192	216
Needle penetration depth	9	97.5	91.2	85	70.9	56.3	45	30	20.2	14.3	9	1.3
	11	96.4	89.7	83.6	69.3	55.1	43.7	28.6	19	12.8	7.7	0.8
	13	95.2	88.3	82.7	66.8	53.8	42.8	27.2	17.6	11.8	6.4	0.4

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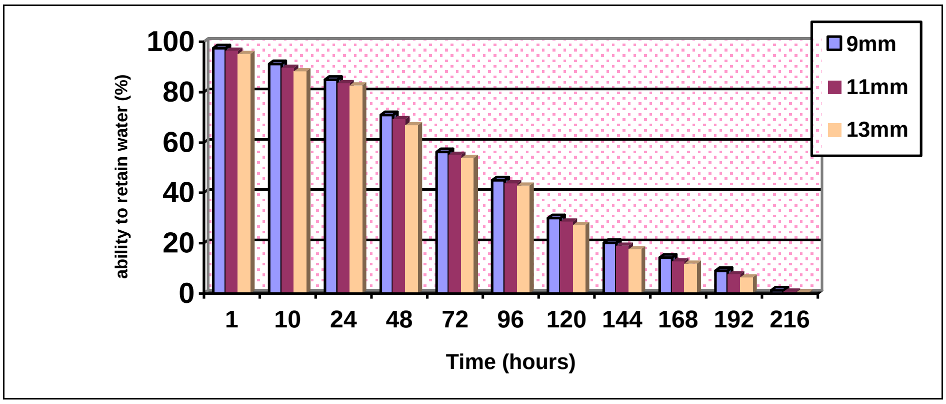

Fig. (11) Effect of needle penetration depth and time on ability to retain water at 1360 gm/m^2

Table (21) Fabric ability to retain water with time measurements results at 1500 gm/m^2

Ability to retain water with time %

weight		1500 gm/m^2													
Time with hour		1	10	24	48	72	96	120	144	168	192	216	240	2642	288
Needle penetration depth	9	96.2	89.4	84.7	77.4	60.4	54.1	47.8	45	39.1	34.4	29.8	22.4	16	5.2
	11	94.8	88	83.2	73.5	59	52.8	46.4	43.3	37.6	33	28.2	20.7	14.8	4.3
	13	93.3	87.3	82.4	71	57.8	51.3	45.6	41.6	36.5	31.5	26.6	19.3	13.6	3

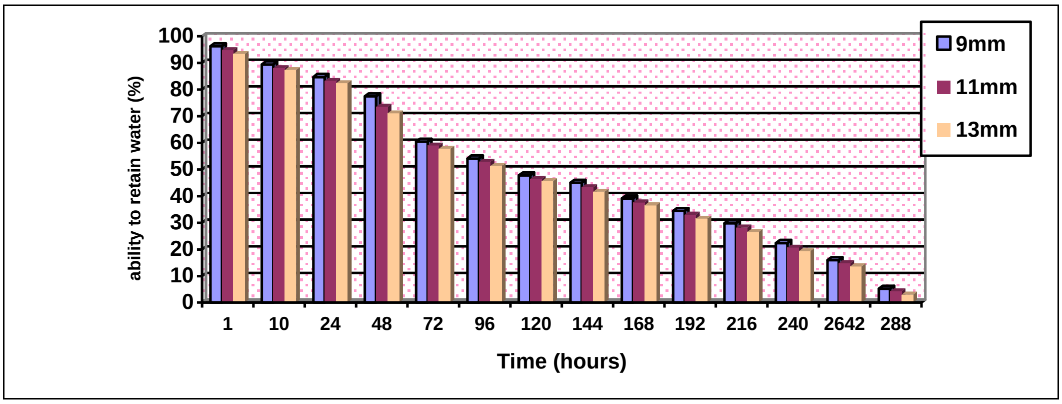

Fig. (12) Effect of needle penetration depth and time on ability to retain water at 1500 gm/m^2

It is obvious from table (17, 18, 19, 20, and 21) and fig. (8, 9, 10, 11, 12) that there is an inverse relationship between fabric ability to retain water and the time of exposure to atmosphere, that can be explain is for all samples under test.

The greater needle penetration depth, the less of its ability to retain water, that is because the increased penetration depth helps to increase the compacted of fabric and therefore less spacing between the fibers which carried with it some water molecules and therefore less ability retains water.

It was noticed that the best sample kept with water for longer period (about 288 hours or 12 days) are the most weight, which weighed 1500 g/m2. Although the increased of weight means increase in the density of fiber per unit area, which means less spacing between the fibers, but the increased of moisture and the time of retention it, due to absorb a longer amount of moisture through the fibers themselves.

Thus, this sample is the best samples under study to the subject of research, based mainly on trying to provide irrigation water.

3.7. Sample decomposition

Table (22): organic carbon, total nitrogen and carbon to nitrogen ration measurements results

O.C %	T. N %	C/N
98.88	0.62	159.5

Whereas:

O.C: organic carbon T.N.: Total nitrogen C/N: carbon to nitrogen ratio

- Decomposition of any organic matter depends on C/N ratio.
- The optimum C/N Ratio needed to accelerate the decomposition is (17: 1) (C: N).
- To accelerate decomposition of organic matter it should be controlling the soil moisture to % from WHC) as well as temperature at (30 – 35^{o} C).
- Surface area: to accelerate the decomposition of organic matter should to increase the surface area for microorganism which is responsible for decomposition.

It is clear from table (22) the basic components of the samples. Where organic carbon was 98.8% and Nitrogen was 0.62, and it is well know that the decomposition of any organic matter depends on C/N Ratio, which found in the table. Rapid decomposition of the fabric happen if the ratio of carbon to nitrogen as 17: 1. It was also known that to accelerate decomposition of organic matter, it should be controlling the soil moisture to 60% as well as temperature at (30 – 35^{o}C) and increases the surface area for microorganism which is responsible for decomposition.

So it is clear from all of the above that, the samples under study would remain in the soil for several years before decomposed. When the samples decomposed after period of time will fertilize the soil.

3.8. Total content of heavy metals in samples

Table (23) Total content of heavy metals measurements results

Pb Lead	Ni Nickel	MO Molybdenum	Cr Chromium	Co Cobalt	Cd cadmium
0.00	177.40	1.20	637.60	2.60	0.00

It is clear from table (23) that the samples under study contains allowable amount of some heavy metals. Most of them were very small amount, but both of nickel and chromium were higher (177.40, 60). It was known that two elements can be having a degree of toxicity, often these two elements from the use of pigment.

So it was advised not to use the pigments in these types of fabrics to prevent soil pollution with toxic substances.

IV CONCLUSIONS

The aim of this work was to produce Agro-Textile non-woven fabrics capable to provide irrigation water and fertilizers. Based on the previously calculated and experimental results of samples under study the researchers concluded the following points:

1- Weight of fabrics has significant effect on fabric tensile strength for length and width, air permeability, absorbency and thickness.
2- Increasing the fabric weight leads to increase the tensile strength, elongation, absorbency and thickness.
3- Increasing the fabric weight leads to decrease the air permeability.
4- Weight of fabrics has no significant effect on fabrics elongation for both length and width.
5- Needles penetration depth has no significant effect on all properties under study.
6- The best sample able to retain water for as long as possible is a sample weighing 1500 gm/m^2.
7- The samples under study would remain in the soil for several years before decomposed, then they become fertilize to the soil.
8- It was advised not to use the pigments in these types of fabrics to prevent soil pollution with toxic substances.

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