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Sand-Compost-Hydrogel Mix for Low Cost Production of Tomato Seedlings

O.A. El-Hady, Safia M. Adam and A.A. Abd El-Kader
National Research Center, Dokki, Cairo, Egypt.

DIFFERENT media were prepared to be used for commercial production of some local hybrids of tomato seedling (*Lycopersicon esculentum*) namely : Dokki 1, Ain Shams 2 and Wady. Examined media were : I. Sandy soil, II or III. medium I mixed with 2% or 4% (W/W) of fine compost (produced by aerobic composting of some local organic wastes, *i.e* town refuse, saw dust, plant residues and organic manure at the ratio of 1 : 1 : 1 : 1), IV or V. medium I mixed with 0.1 % or 0.2 % (w/w) of an absorbent material (mixture of an anionic " polyacrylamide k polyacrylate 30 % anionicity" and a cationic "polyacrylamide allylamine hydrochloride 20 % cationicity" hydrogels at the ratio of 2 : 3) and VI, VII and VIII. medium I mixed with mixture of examined compost and hydrogel at the ratio of 1% compost + 0.1% hydrogel, 2% compost + 0.1% hydrogel and 2% compost + 0.2% hydrogel (w/w), respectively. Fertigation was carried out twice a week using 1 g / 1 fertilizer solution 19:19:19. Some growth parameters (*i.e.* Germination percentages; seedlings height; stem diameter; leaves number and area; fresh and dry weight of seedlings); N, P and K content and both water and fertilizers use efficiency by produced seedling as well as some physico-bio-chemical properties of the media at the end of the growing period, were taken as bases for preference.

Under the conditions of conducted experiment and taking the economical aspects into consideration, the hybrid Wady and the growing medium No. VII seem to be suitable. Production of 1000 seedlings needs 250, 5 and 0.25 kg of sand, compost and hydrogel, respectively, that cost ≈ 7 L.E.

Keywords : Growing media, Compost, Hydrogel, Sand, Tomato.

There are great needs for producing low priced horticultural substrates to be used in propagation, tree nursery, pot plants, fruits, vegetables and cut flower growing. These growth media must combine favourable physical and bio-chemical properties that offer optimal conditions to the plants. The abundance of their raw materials locally-particularly those of plant residues - easiness of preparation and at the same time environmentally safe are of preference.

Tomato (*Lycopersicon esculentum*) is considered as one of the most essential vegetable crops for human nutrition in most countries. In Egypt, tomato is the 1st vegetable crop that occupies about one third of the total cultivated area with vegetables. To overcome the great needs for more production, vast desert area has to be put under cultivation with tomato. Seedlings production of tomato hybrids cabable to friut setting under severe conditions of such soils, particularly drought and salinity, is a must. Of these are Wady, Dokki-1 and Ain Shams-2 (Abd-Allah *et al.*, 1996 and 1999).

Previous studies indicated the improving effect of organic materials (hydrogels) on hydro-physical, bio-chemical properties and nutritional status of sandy soils on one hand and growth, nutrients uptake and both water and fertilizers use efficiency by growing plants on the other hand (El-Hady *et al.*, 1995 a and b, 2000 a and b, and 2001 a and b; Abd El-Hameed *et al.*, 1995; El-Sherbeiny *et al.*, 1995; Abd El-Hady *et al.*, 1997 and El-Hady and Hefny, 2001). It is expected that mixing sand medium with some organic materials (composts) and super absorbent materials (hydrogels) will gain the beneficial effects of both types of soil conditioners. The resultant, *i.e.* obtained media may offer more favourable conditins for growing plants. Therefore, the aim of the present work is to evaluate some sand-compost-hydrogel mixtures as low priced growth media for producing tomato seedlings.

Material and Methods

A completely randomized green house experiment with 4 replications for each treatment (noteworthy that each replicat includes (6 plants),) Cochran and cox, 1957 and Steel and Torri, 1980 was conducted as follows:

Examined media (substrates)

Different media were prepared to be used for commercial production of some hybrids of tomato seedling. Prepared media were:

I. Sandy soil of which more than 90% consists of particles > 20μ . The main analytical data of the medium are shown in Table 1.

TABLE 1. Analytical properties of sandy soil (medium I).

1. Mechanical analysis

Sand		Silt 20-2 µ %	Clay < 2 µ %	Soil Texture
Course >200 µ %	Fine 200-20µ %			
55.2	32.6	7.4	4.8	Sandy

2. Chemical analysis

pH 1:2.5	EC dSm^{-1} 1:5	$CaCO_3$ %	CEC C mole Kg^{-1}	OM %	Macro – nutrients (ppm)					
					Total			Available		
					N	P	K	N	P	K
8.42	0.4	2.65	3.15	0.10	490	835	1920	41	10	152

3. Hydrophysical properties

Bulk Density Kg/m^3	Total Porosity %	Water holding capacity *%	Field capacity * %	Wilting Percentage*	Hydraulic Conductivity m day^{-1}	Mean diameter of soil pores µ
1.596	39.77	19.72	6.15	1.33	9.12	18.7

- On dry weight basis.

II or III. medium I mixed with 2% or 4% (w/w) of fine compost produced by aerobic composting of some local organic wastes, *i.e* town refuse, sawdust, plant residues and organic manure at the ratio 1:1:1:1, respectively. Table 2 presents the main chemical properties of applied compost.

IV or V. medium I mixed with 0.1% or 0.2% (w/w) of an obsorbent material mixture of the anionic " hydrogel polyacrylamide k polyacrylate gel 30% anionicity" and the cationic " hydrogel polyacrylamide allylamine hydrochloride gel 20% cationicty" at the ratio of 2:3). Description of the main constituents and properties of hydrogel used are given in Table 3. VI, VII. and VIII medium I mixed with mixtures of examined compost and hydrogel at the rates of 1% compost + 0.1% hydrogel (w/w) for medium VI, 2% compost + 0.1 hydrogel (w/w) for medium VII and 2% compost + 0.2% hydrogel (w/w) for medium VIII.

TABLE 2. Some chemical properties of applied compost.

pH (H2O)			7.32
Salinity : EC dS m^{-1}			1.3
	Na^+ %		0.02
Moisture : %			4.11
Mineral content % (ash%)			28.80
Organic component :	O.M %		67.09
	O.C %		38.91
	O.N %		2.09
	C:N		15.75
Macro elements:	$NH^+_4 + NO_3$ %		0.02
	P_2O_5 %		0.35
	K_2O %		0.48
Secondary elements :	Ca^{2+} %		1.12
	Mg^{2+} %		0.36
Micro elements:	Fe	ppm	116.0
	Mn	ppm	51.0
	Zn	ppm	45.0
	Cu	ppm	12.5
Heavy metals:	Cd	ppm	0.40
	Co	ppm	0.60
	Ni	ppm	2.02
CEC		C mole kg^{-1}	135

Tomato hybrids

Three locally produced hybrids of tomatoes (*Lycopersicon esculentum*) namely : Dokki-1, Ain Shams 2 and Wady were chosen. As previously mentioned, this choice was for their cabability to fruit setting under severe conditions of our deserts particularly drought and salinity.

Experimental layout

Two hundred and fifty grams of each of examined media were uniformly packed in black polyethylene sacks. Water (50ml) was slowly added to allow complete hydration of organic composts or hydrogel or their mixtures then covered with plastic sheet. After two days (for equilibrium) each medium was planted with tomato seed. Fertigation was carried out using 1 g /1 complex fertilizer (19:19:19). Thirty milliliters of the solution were applied / irrigation twice a week. This corresponds to ≈ 60% of the total water holding capacity of medium I. After one week, germination % was calculated. At the end of the 5th week, seedlings were ready for transplantation on the open field.

TABLE 3. Description of the main constituents and properties of hydrogels used.*

a – Main constituents	Anionic	Cationic
Active substance	Propeneamide Propionic acid Co-polymer (K-salt)	Propeneamide allylamine Co-polymer (Cl- salt)
Ionization degree	30 mole %	20 mole %
Cross linker	Divalent vinyl monomer	
Cross linking ratio	$1: 10^{-4}$	
Percentage of active substance	Greater than 88%	
Monomer content	Not higher than 300 ppm	
b- Properties		
Appearance:	White to slightly yellow grains	
Grain size	0.25 - 1 mm	
Bulk density:	≈ 600 kg/m³	
Solubility :	Insoluble in water and organic solvents	
pH 0.1 % in distilled H2O	7± 0.5	
CEC C mole kg^{-1}	2045	2175
Absorption capacity in g/g hydrogel :		
Deionized water	= 525	= 430
0.9 % NaCl	= 44	= 35
0.4 % $CaCl_2$	= 41	= 36
Saline water 1500 ppm	= 64	= 54
Absorption time :		
Up to 50 %	20 minutes	
Total absorption	60 minutes	

* The used hydrogels were prepared through the scientific co-operation program between prof. Dr El-hady, O.A of the National Research Center , Cairo , Egypt and Dr. Pieh, S. of the Research and Development Dept. Chem. Linz GESMBH, Linz, Austria (Pieh and El-Hady 1990).

Studied parameters

The following parameters were undertaken to evaluate the suitability of examined media for the economical production of seedlings.

1- Germination % after one week from sowing.

2- Growth response at the end of the growing period (5 weeks), i.e plant height, stem diameter, leaves number and area /plant, fresh and dry weight of obtained seedlings.

3- Nitrogen, P and K content of seedlings (Cottenie *et al.*, 1982).

4- Water use efficiency by plants calculated as grams of fresh weight produced by a unit (II) of irrigation water used.

5- Fertilizers use efficiency by plants calculated as grams of fresh weight produced by a unit (1g) of added nutrients.

6- Some physico-bio-chemical properties of the media at the end of the growing period, *i.e.* pore size distribution, moisture retention and available water (Loveday, 1974), infiltation rate (IR) (Michael, 1978) and adjusted evaporation (Eadj), (Azzam and El-Hady, 1983-b) pH, OM content, CEC, C:N ratio and available N , P and K (Cottenie *et al.*, 1982), total count of micro organisms (Difco, 1966 for bacteria, Szabo, 1974 for actinomyses and Allen, 1953 for fungi), and activity of dehydrogenase (Skujins, 1973) and phosphatase (Khaziev, 1968).

Results and Diseussion

1. Germination percentages, growth response, nutrients uptake and fertilizers use efficiency by tomato seedlings

Germination percentages; some growth parameters i.e. plant height, stem diameter, leaves number and area / plant and fresh and dry weights of the seedlings are presented in Table 4 and illustrated in Fig. 1. Nitrogen, P and K contents of the seedlings are shown in Table 5 and illustrated in Fig. 2 . Water and fertilizer use efficiency of the produced seedlings are inserted in Table 6. Obtained results could be summarized as follows:

1- There is no problem with seed germination either in the studied media or with examined hybrids: no significant differences were calculated between the values of gramination percentages. For all treatments, germination percentage exceeded 94.0.

2- Increases in growth parameters were recorded. They reached 13.8 or 17.0% for the plant height; 10.7 or 17.9% for the stem diameter; 23.1 or 30.9% for the number of leaves /plant; 26.1 or 45.0% for leaves area /plant; 21.3 or 25.8% for the fresh weight of seedlings and 19.7 or 24.6% for the dry weight of seedlings over those grown in medium I (sandy soil) by mixing this medium with 4% compost (medium III) or 0.2% hydrogel (medium V). Mixing both types of additives together (compost + hydrogel) increased the aforementioned parameters by 8.9, 14.3, 23.1, 18.2, 17.3 and 16.4%, respectively for seedlings grown in medium VI, *i.e.* when mixing sandy soil with 1% compost + 0.1% hydrogel. Relevant increases for seedlings grown in medium VII, *i.e.* sandy soil mixed with 2% compost + 0.1% hydrogel were 17.9, 19.6, 30.9, 40.5, 23.9 and 23.5 in sequence. Increasing hydrogel concentration through applying 2% compost + 0.2% hydrogel (medium VIII) decreased most of the studied growth parameters by ~ 12% but the growth was still higher than that of medium I.

TABLE 4. Germination percentages and some growth parameters of tomato seedlings grown in different sand-compost hydrogel mixtures.

a. Effect of growing medium

Ex. Med.	Medium components			Germination %	Plant height cm	Stem diameter cm	Leaves number/ plant	Leaves area / plant cm²	Fresh weight g / plant	Dry weight g/ plant
	Sand	compost	hydrogel							
I	1000	0	0	95.6	18.57	0.56	4.33	97.00	5.033	0.607
II	980	20	0	95.9	20.27	0.59	4.33	104.33	5.667	0.680
III	960	40	0	96.4	21.13	0.62	5.33	122.33	6.100	0.733
IV	999	0	1	96.3	20.83	0.61	5.00	113.67	5.967	0.717
V	998	0	2	97.6	21.73	0.66	5.67	140.67	6.333	0.760
VI	989	10	1	96.7	20.23	0.64	5.33	114.67	5.900	0.710
VII	979	20	1	96.0	21.90	0.67	5.67	136.33	6.233	0.753
VIII	978	20	2	95.1	18.77	0.59	5.00	103.00	5.500	0.660
L.S.D 0.05				N.S	2.16	0.05	0.46	10.23	0.650	0.060

* Each value is the mean of 72 plants.

b. Effect of examined hybrid.

Examined hybrid		Germination %	Plant height cm	Stem diameter cm	Leaves number/ plant	Leaves area / plant cm²	Fresh weight g / plant	Dry weight g/ plant
1	Dokki 1	94.8	17.99	0.57	4.75	107.63	5.063	0.609
2	Ain Shams 2	95.2	20.48	0.58	5.00	114.00	5.300	0.636
3	Wady	98.6	22.83	0.70	5.50	127.88	7.163	0.863
L.S.D 0.05		N.S	1.63	0.03	0.38	8.12	0.420	0.041

*Each value is the mean of 192 plants.

3- Similarly, mixing medium I with organic compost or / and hydrogel increased N, P and K uptake by seedling. For N, these increases reached 32.1, 35.0, 40.6, 56.3 and 43.4% using 4%, 0.2% hydrogel, 1% compost +0.1 hydrogel, 2% compost+0.1% hydrogel and 2% compost+ 0.2% hydrogel, respectively. The same was true with P and K increments in their uptake reached 61.3, 68.0, 68.50 and 50.5% for P and 55.6, 66.8, 50.9, 62.5, for K due to growing tomato seedlings in the aforementioned medium, in sequence.

4- Either water or fertilizers use efficiency of the produced seedlings were increased to be 1.22, 1.26, and 1.25 times that of medium I using 4% compost (medium III), 0.2% hydrogel (medium V) and 2% compost + 0.1% hydrogel, (medium VII), respectively.

5- For all studied parameters the hybrid Wady shows superiority followed by the other two hybrids Ain Shams 2 and Dokki-1.

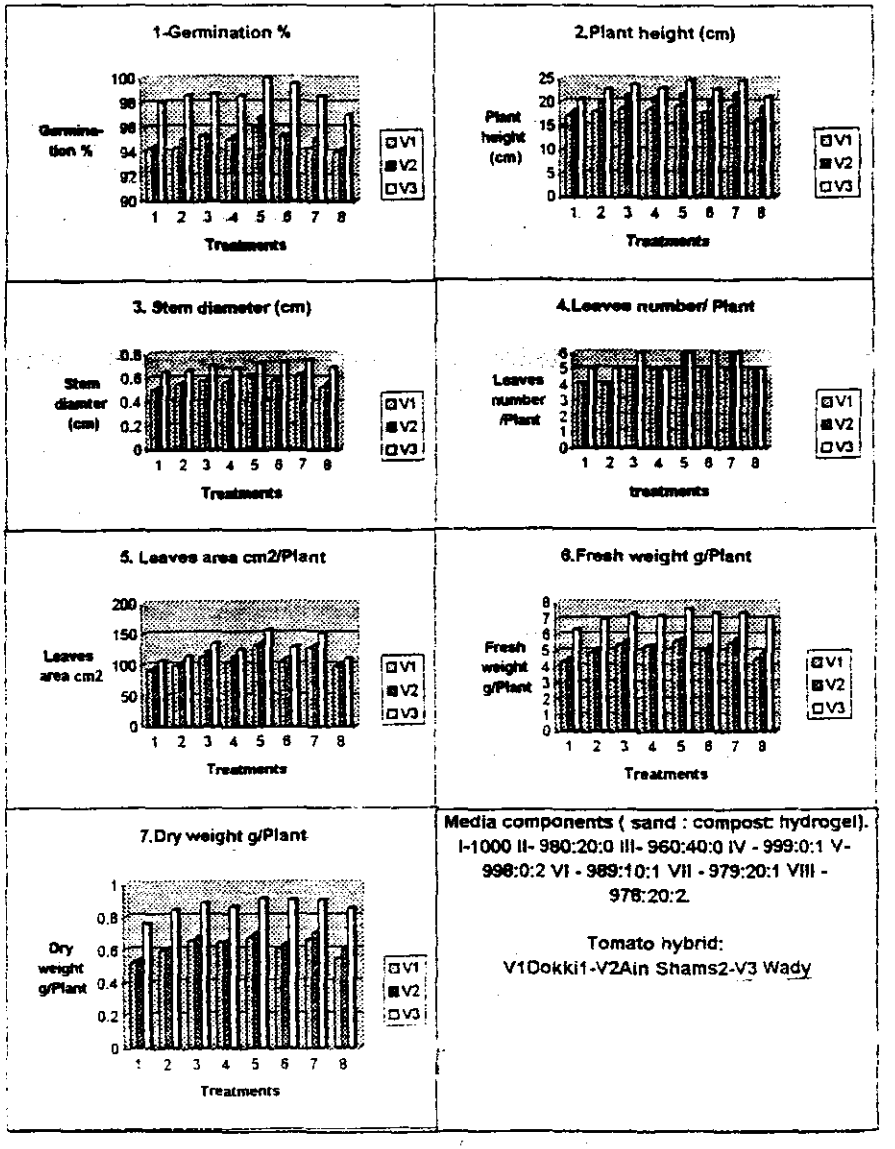

Fig. 1. Germination percentage and some growth parameters of tomato seedlings grown in different sand-compost-hydrogel mixtures.

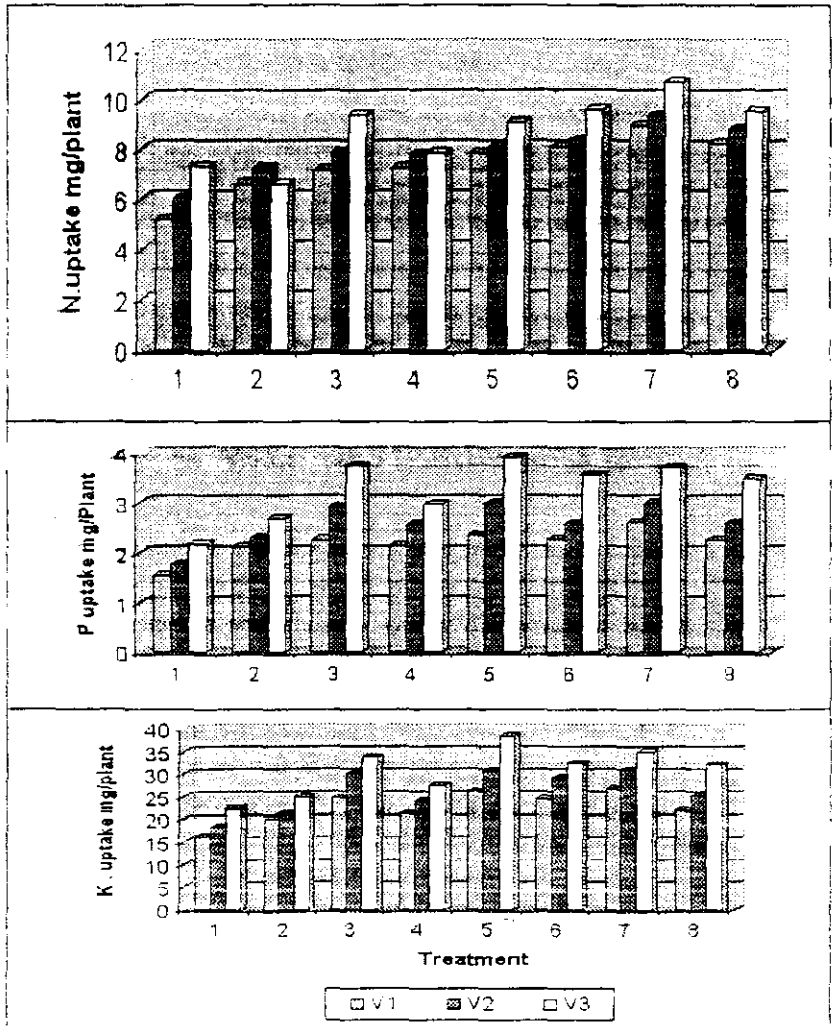

Fig. 2. Nutrients uptake by tomato seedlings grown in different sand-compost-hydrogel mixtures.

Physico-bio-chemical properties of the media at the end of seedling growth period and just befor transplanting

Some Physico - bio - chemical properties of examined substrates at the end of seedling growth period and just before transplanting are presented in Table 7 a and b. The positive effects of mixing either organic compost or the hydrogel or both with sand media could be considered as bases for discussing the differences in seedlings growth, nutrients uptake and both water and fertilizers use efficiency

TABLE 5. Nutrients uptake by tomato seedlings grown in different sand-compost hydrogel mixtures.

a. Effect of growing medium:

Ex. Med.	Medium components			N	P	K
	Sand	compost	hydrogel	Mg/ plant	Mg/ plant	Mg/ plant
I	1000	0	0	6.177 ± 1.054	1.84 ± 0.314	19.03 ± 3.277
II	980	20	0	7.159 ± 0.483	2.36 ± 0.291	22.19 ± 2.596
III	960	40	0	8.159 ± 1.146	2.97 ± 0.742	29.61 ± 4.513
IV	999	0	1	7.618 ± 0.303	2.56 ± 0.405	24.37 ± 3.090
V	998	0	2	8.339 ± 0.630	3.09 ± 0.795	31.74 ± 6.162
VI	989	10	1	8.685 ± 0.784	2.81 ± 0.668	28.72 ± 3.851
VII	979	20	1	9.655 ± 0.905	3.10 ± 0.560	30.92 ± 4.118
VIII	978	20	2	9.958 ± 0.643	2.77 ± 0.607	26.55 ± 5.04[illegible]

b. Effect of examined hybrid

Examined hybrid		N	P	K
		Mg/ plant	Mg/ plant	Mg/ plant
1	Dokki -1	7.43 ± 1.152	2.20 ± 0.298	22.78 ± 3.557
2	Ain Shams -2	7.94 ± 1.008	2.59 ± 0.407	25.30 ± 4.747
3	Wady	8.87 ± 1.176	3.28 ± 0.611	30.85 ± 5.319

of the plants. This could be summarized as follows: 1) Both organic composts and hydrogel promote good and stable soil structure with suitable pore size distribution towards the fine pores, *i.e* water holding pores, increases the water holding capacity of the media and the ability of the media to retain more available water, improves the dynamic soil water characteristice, *i.e* decreasing downward movement of water through infiltration and the upward movement of it via evaporation, (El-Hady & Azzam, 1983; El-Hady, 1987; Abd El-Hady *et al.*, 1997; Abd El-Hameed *et al.*, 1995; El-Hady *et al.*, 1983, 1995a and b and 2000b; El-Hady & Hefny, 2001, Tayel & El-Hady, 1981). 2) Both components when mixed with sand medium lower its pH that lead to more solublization of nutrients and increasing nutrients availability and increase the low exchange capacity of the medium that increases its nutrients retention abilities and in turn minimizing the loss of such nutrients by leaching and deep percolation (El-Hady *et al.*, 2000a 2001a, b and c), increasing the microbial biomass and enzymes activity indicating an improvement in biological properties of the media (El-Hady *et al.*, 2000 b, 2001b) The high moisture retention in the medium No. VIII over the needs of growing seedlings - and its adverse effects on aeration of the root zone - as a result of increasing the micro porosity of the medium on the expense of its macro ones, may explain why growth parameters, nutrients uptake and both water and

TABLE 6. Water and fertilizer use efficiency of tomato seedlings grown in different sand-compost-hydrogel mixtures.

Ex. Med.	Meaum components			Examined hybrid		*Water use effic-ency g/l	**Fertilizers use efficiency g/g		
	Sand	Compost	hydrogel				N	P	K
I	1000	0	0	1	Dokki-1	12.286	75.439	172	90.909
				2	Ain Shams-2	12.857	78.947	180	95.137
				3	Wady	18.000	110.526	252	133.192
II	980	20	0	1	Dokki-1	14.000	85.965	196	103.594
				2	Ain Shams-2	14.571	89.474	204	107.322
				3	Wady	20.000	122.807	280	147.992
III	960	40	0	1	Dokki-1	15.429	94.737	216	114.165
				2	Ain Shams-2	16.000	98.246	224	118.393
				3	Wady	20.857	128.070	292	154.334
IV	999	0	1	1	Dokki-1	15.143	92.982	212	112.051
				2	Ain Shams-2	15.429	94.737	216	114.165
				3	Wady	20.571	126.316	288	152.270
V	998	0	2	1	Dokki-1	16.000	98.246	224	118.393
				2	Ain Shams-2	16.571	101.754	232	122.622
				3	Wady	21.714	133.333	304	160.677
VI	989	10	1	1	Dokki-1	14.286	87.719	200	105.708
				2	Ain Shams-2	15.143	92.982	212	112.051
				3	Wady	21.143	129.825	296	156.448
VII	979	20	1	1	Dokki-1	15.714	96.491	220	116.279
				2	Ain Shams-2	16.571	101.754	232	122.622
				3	Wady	21.143	129.825	296	156.448
VIII	978	20	2	1	Dokki-1	12.857	78.947	180	95.137
				2	Ain Shams-2	14.000	85.965	196	103.594
				3	Wady	20.286	124.561	284	150.108

*Calculated as grams of fresh weights produced by a unit (1l) of irrigation water used.

**Calculated as grams of fresh weights produced by a unit (1g) of added nutrients

fertilizers use efficiency of the growing plants decreased by increasing the amount of applied hydrogel in the medium, compare data of medium VII with those of medium VIII, (El-Hady *et al.*, 1983 and 1990 and El-Sherbiny *et al.*, 1995). So, it is recommended to use lower rates of hydrogels in the mixture, *i.e* applying 2% compost + 0.1% hydrogels (medium VII) or increasing the ferquency of irrigation *i.e.* reducing number of irrigations / season.

Under the conditions of the conducted experiment, and taking the economical aspects into consideration the hybrid Wady and medium No. VII seem to be the suitable ones. Production of 1000 seedlings needs 250, 5 and 0.25 kg of sand, compost and hydrogel, respectively, that cost = 7 L.E.

TABLE 7. The main analytical data of examined substrates at the end of seedling growth period and just before transplanting.

a. Hydro-physical properties:

Ex. Med.	Medium components			Macro-pores %	Water holding pores %	Mean diameter of soil pores μ	WHC* %	FC* %	Avail-able* moisture %	IR cm hr⁻¹	E. adj.
	Sand	compost	hydrogel								
I	1000	0	0	30.6	7.8	19.1	19.6	6.1	4.8	63.7	1.000
II	980	20	0	26.4	10.2	16.8	21.9	7.8	6.4	46.2	0.902
III	960	40	0	25.2	12.1	15.9	23.1	9.1	7.6	41.8	0.826
IV	999	0	1	25.1	12.6	15.1	25.6	8.1	7.1	40.2	0.843
V	998	0	2	22.8	18.3	13.7	31.2	12.8	11.8	33.6	0.615
VI	989	10	1	28.5	12.8	14.8	26.8	8.4	7.8	38.1	0.695
VII	979	20	1	25.6	13.5	14.4	27.4	9.8	8.9	36.4	0.639
VIII	978	20	2	20.9	20.3	12.8	35.1	14.3	12.6	31.6	0.516

* on weight basis

b. chemical and biological properties

Ex. Med.	Medium components			pH	CEC Cmole kg⁻¹	OM %	C/N	Available mgkg⁻¹			Total micro-org. x 10^6 /g	Enzyme activity	
	Sand	compost	hydrogel					N	P	K		Dehydr-ogenas**	Phos-phates***
I	1000	0	0	8.57	3.01	0.10	11.98	35.1	32.7	151.3	295	4.1	16.4
II	980	20	0	8.50	4.82	0.46	5.01	69.1	51.3	422.6	920	21.8	41.3
III	960	40	0	8.44	6.10	0.91	6.48	83.4	76.9	583.4	1880	39.6	65.6
IV	999	0	1	8.36	5.01	0.22	8.92	51.1	45.4	264.6	530	7.9	24.1
V	998	0	2	8.21	7.15	0.31	6.65	76.1	62.5	351.2	625	11.1	36.5
VI	989	10	1	8.24	6.15	0.52	7.15	66.2	59.6	401.3	930	25.2	42.4
VII	979	20	1	8.34	5.96	0.65	7.74	73.4	83.1	622.4	960	27.9	48.3
VIII	978	20	2	8.42	8.58	0.77	7.42	89.1	96.5	793.6	1150	36.8	60.3

*Bacteria, fungi and actionomycetes.

** mlH_2 /g dry soil / 24 h.

*** mg P_2O_5 / 100 g dry soil / 24 h.

References

Abd-Alla, A.M., Adam, S.M., Abou-Hadid, A.F. and Benjamien, I.S. (1996) Productivity of tomato as influenced by different air tempraturs. Phosphoric and potassium fertilizers. *Acta Horticultrae,* **434,** ISHS, 113 .

Abd-Alla, A.M., Adam, S.M. and Abou-Hadid, A.F. (1999) Response of some tomato hybrids to organic fertilizers under newly reclaimed soil conditions. *Six Inter. Conf. On the Development of Dry Lands* Cairo, Egypt.

Abd El-Hady, B.M., El-Hady, O.A., Rizk, N.A. and El-Saify, E.S. (1997) The potentiality for improving plant - soil - water relations in sandy soil using some synthesized Am Na (or) ATEA hydrogels. *4th Arab Int. Conf. On Polymer Science and Tech.* Sep. 8-11, 1997 Cairo, Egypt.

Abd El-Hameed, M.W., El-Hady, O.M., Hammad, S.A. and Kotb, M.Th. (1995) Effect of incorporating organic manure or / and hydrogels in sandy soil on soil structurization and stabilization. *Egypt. Soil Sci. Soc. (ESSS)* 5^{th} *Nat. Cong. (Bio-agriculture in Relation to Environment)* Nov. 20-21, 1995, Cairo, Egypt.

Azzam, R. and El-Hady, O.A. (1983 b) Sand - RAPG combination simulating fertile clayey soil. II. Water preservation. *Int. symp. Isotope and Radiation Techniques in Soil Physics and Irrigation Studies* IAEA-SM - 167 / rs, 330-335 and 336-342 .

Cochran, W.G. and Cox, G.M. (1957) *"Experimental Designs"* , 2^{nd} ed., Jon Willey and sons Inc., New York.

Cottenie, A., Verloo, M., Kekens, L., Velghe, G. and Camberlynck, R. (1982) *Chemical Analysis of Plants and Soil.* Lab. Agroch. State Univ. Ghent, Belgium.

Difco Manual (1966) *Manual Dehydrated Culture Media and Reagents of Microbiological and Clinical Laboratory Procedure* 10^{th} ed. Defico, Lab. Inc. Detroit, L, Michigan, USA.

El-Hady, O.A. (1987) Hydrogels for increasing water and fertilizers use efficiency in sandy soils. 1^{st} *Conf. On Fertilizers Availability and Needs. S.W.R.I., A.R.C, Ministry of Agric., Egypt,* 13-16 April, 478-496.

El-Hady, O.A., Abd El-Hady, B.M. and Kotb, M. Th. (1995a) Hydrogels for improving the conditioning effect of manure. I. Influence on some hydrophysical properties of sandy soils. *Egypt. Soil Sci. Soc. (ESSS)* 5^{th} *Nat. Cong.* Nov. 20-21, 1995, Cairo.

El-Hady, O.A., Hammad, S.A., Shiha, A.A. and Kotb, M.Th. (1995b) Effect of treating sandy soil with organic manure or / and hydrogels on water movement and preservation. *Egypt. Soil Sci. Soc. (ESSS) 5th Nat. Cong. (Bio-agriculture in Rlation to Environment)* Nov. 20-21, 1995, Cairo, Egypt.

El-Hady, O.A., Abd El-Hady, B.M., and Abd El-Kader, A.A. (2001a) Leachability of fertilizer nutrients from sandy soils as influenced by the inoicity of applied polyacrylamide hydrogels *6th Arab International Conference on Polymer Science and Technology,* 1-5, Septemper 2001, Ismailia, Sharm El-Sheikh, pp. 133-146.

El-Hady, O.A., Abd El-Kader, A.A. and Abou Sedera, S.A. (2001b) The conditioning effect of organic manure (natural) or / and acrylamid hydrogels (synthesized) on a sandy calcareous soil. II. Chemical and biological properties of soil. *Egypt. J. Soil Sci.,* **42**(1-4).

El-Hady, O.A., Abd El-Kader, A.A. and Badran, Nadia M. (2001-c) Forage yield, nutrients uptake and water and fertilizers use efficiency by ryegrass (*Lolium multiflorum* L.) grown on a sandy calcareous soil treated with acrylamide hydrogels or / and manures. *J. Agric. Sci. Mansoura Univ.* **26**(6), 3465.

El-Hady, O.A., Abou Sedera, S.A. and Abd El-Kader, A.A. (2000a) Hydrogels for improving the conditioning effect of manures. II- Influence on some chemical and biological properties of sandy soil. *Egypt. Soil Sci. Soc., Golden jubilee Cong. On Soil and Sustainable Agriculture in the New Century, Oct.* 23-25, *2000, Cairo,* Paper No. P-3-50, *Egypt. J. Soil Sci.*, **42** (1-4).

El-Hady, O.A. and Azzam, R. (1983) The potentiality for increasing plant available water in sandy soils using PAMG2. *Egypt. J. Soil Sci.* **23**(3), 243.

El-Hady, O.A. and Azzam, R., Lotfy, A. and Hegela, M. (1983) Sand RAPG combination simulating ferile clayey soil. IV. Plantation and natritional status. *Int. symp. On Isotop and Radiation Techniques in Soil Physics and Irrigation Studies IAEA and FAO. Aix en province, France, 18-22 April 1983,* IAEA-S.M. 167/15: 342-349.

El-Hady, O.A., El-Sherif, A.F., Saleh, A.L. and Abdel-Kader, A.A. (2000b) Effect of incorporating organic manure and / or acrylamide hydrogels in sandy soil on growth response, nutrients uptake and water and fertilizers use efficiency by ryegrass plants. *Xth Coll. For the optimization of plant nutrition on "plant nutrition for the next Millennium. Nutrients, yield quality and environment" IAOPN and NRC.* April 8-13, 2000 Cairo Egypt.

El-Hady, O.A. and Hefny, S.M. (2001) The conditioning effect of organic manure (natural) or / and acrylamide hydrogels (synthesized) on a sandy calcareous soil. I-Hydrophysical properties of soil. *Egypt. J. Soil Sci.* **42** (1-4).

El-Hady, O.A., Pieh, S.H and Osman, S. (1990) Modified polyacrylamide hydrogels as conditioners for sandy soils. III. Influence on growth, water and fertilizer use efficiency by plants. *Egypt. J. Soil. Sci.* **30**(3), 423.

El-Sherbieny, A.E., El-Hady, O.M., Hammad, S.A. and Koth, M.Th. (1995) Effect of incorporating organic manure or / and hydrogels in sandy soil on germination,

nutrients uptake and water fertilizer use efficiency by some economical crops. *Egypt. Soil Sci. Soc. (ESSS) 5 th Nat. Cong. (Bio-agriculture in Relation to Environment) Nov. 20-21. Cairo*, Egypt.

Khaziev, F.K. (1968) Methods of total phosphatase activity of the soil. In: :*"Symp. Soil Enzymes" Minsk*, p. 245.

Love day, J. (1974) Methods for analysis of irrigated soils. *Technical Communication No. 54 of the Commonwealth Buearu of Soils.* Commonwealth Agricultural Bureau

Micheal, A.M. (1978) *"Irrigation, Theory and Practice."* Vikas Puplishing house PVT LTD. New Delhi, p. 80.

Pieh, S.M. and El-Hady, O.A. (1990) Modified polyacrylamide hydrogels as conditioners for sandy soil. I. Structure, properties relationshipes of some nonionic and anionic polymeric networks. *Egypt. J. Soil Sci.*, **30** (1-2), 159.

Skujins, J. (1973) Dehydrogenase. An indicator of biological activities in arid soils. *Soils Bull. Eco. Res. Comm.*, **17**, 235.

Szabo, I. (1974) *Microbial Communities in a Forst - Rendzina Ecosystem.* Akademia Kiado, Budapest.

Steel, R.G.D. and Torrie, J.H. (1980) *Principles and Procedures of Statistics*, 2nd ed. Mc.Graw - Hill Co., N.Y., USA.

Tayel, M.Y. and El-Hady, O.A. (1981) Super gel as a soil conditioner. I. Its effect on some soil water relations. *Acta Horticulturae*, **119**, 247-256 and Short Notes in *Egypt. J. Soil Sci., Special Issue* "Soil Conditioners", pp. 105-106.

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خلطات من الرمل والكمبوست والهيدروجيل للإنتاج الاقتصادى لشتلات طماطم

عمر عبد العزيز الهادى ، صفية محمد آدم و عبد القادر عبد الفتاح عبد القادر
المركز القومى للبحوث - الدقى - القاهرة - مصر .

حضرت عدة بيئات لاستخدامها فى الإنتاج الاقتصادى لشتلات بعض الهجن المحلية من الطماطم (دقى ١ و عين شمس ٢ و وادى) وكانت البيئات المحضرة كالتالى :
بيئة رقم (١) : تربة رملية نسبة الرمل فيها تزيد عن ٩٠٪ - البيئات أرقام (٢و٣) : البيئة رقم ١ بعد معاملتها ب ٢٪ (للعينة رقم ٢) و ٤٪ (للعينة رقم ٣) وزناً من الكمبوست الناعم الناتج عن الكمر الهوائى لبعض المخلفات العضوية المنتجة محلياً (مخلفات القمامة - نشارة الخشب - مخلفات المزرعة والسماد البلدى بنسبة ١:١:١). البيئات أرقام (٤ و ٥) : البيئة رقم ١ بعد معاملتها ب ١٪ (للبيئة رقم ٤) و ٢٪ (للبيئة رقم ٥) وزنا من مواد ماصة للماء مكونة من خلط مركب الهيدروجيل الانيونى بولى اكريلاميد بوتاسيوم اكريلات جل (٣٠٪ انيونية) ومركب الهيدروجيل لكاتيونى بولى اكريلاميد الليل امين هيدروكلوريد (٢٠٪ كاتيونية) بنسبة ٣:٢ وزنا. البيئات أرقام (٦و٧و٨) : البيئة رقم ١ بعد معاملتها بخليط من الكمبوست والهيدروجيل بمعدل إضافة ١٪ كمبوست + ٠,١ ٪ هيدروجيل (للبيئة رقم ٦) و ٢٪ كمبوست + ٠,١٪ هيدروجيل (للبيئة رقم ٧) و ٢٪ كمبوست + ٠,٢٪ هيدروجيل (للبيئة رقم ٨). ثم الرى والتسميد بمحلول ١جم / لتر من سماد ١٩:١٩:١٩ مرتين أسبوعياً .

اتخذت النسبة المئوية للانبات وبعض مقاييس النمو (طول الشتلة- قطر الساق - عدد ومساحة الأوراق -الوزن الخضرى والوزن الجاف للشتلات) ومحتوى الشتلات من عناصر لنتروجين الفوسفور و البوتاسيوم وكفاءة استخدام الشتلات لكل من مياه الرى والاسمدة المضافة وبعض الخواص الفيزيوبيوكيميائية للبيئة فى نهاية فترة النمو كاساس للتفضيل .

تحت ظروف التجربة المقامة ومع الأخذ فى الاعتبار الجدوى الاقتصادية فإن الهجن (وادى) والبيئة رقم ٧ يبدو مناسبين . انتاج ١٠٠٠ شتلة طماطم يحتاج الى ٢٥٠ كجم رمل و ٥ كجم كمبوست ٢٥, كجم هيدروجيل ويتكلف حوالى ٧ جنيهات مصرية .