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Technical Report About Evaluation of WEFASAN Application on soil and Grown Plants

A Technical Report

About

The Response of Soils and Plants to WEFASAN Application

Response of both cultivated soils and plants to application of WEFASAN compound was evaluated through out analyzing soil and plant samples. Some soil properties as well as growth, yield and nutritional status of grown plants were evaluated to clarify the role(s) of WEFASAN application in improving soil fertility and the nutritional status as well as yield of grown plants.

I- Response of Soils

Samples of three types of soils (sandy, calcareous and clayey) were incubated for 90 days at irrigation level of 60 % field capacity. Four levels of WEFASAN (0, 500, 1000, 1500 cm^3/feddan) were applied at the beginning of incubation period with or without application of 1 % soil organic (compost) or inorganic (bentonite) conditioner. Then, some soil characteristics were determined by a specific team, belonging to the water and soil analyses unit, at the analytical labs of Soil Dept., Faculty of Agric., Ain Shams University, Cairo Egypt, to evaluate WEFASAN action.

Representative data (Table, 1) showed that WEFASAN application improved the level of organic matter as well as the structure of treated soil. So that, commutative water quantities consumed for keeping soil moisture level were found to be decreased as WEFASAN application rate increased. Similar trend was also encountered for the nutrient (macro and micro) availability in soils. Quantities of available macronutrients (nitrogen and potassium and to a lesser extent phosphorus) and micronutrients (iron, manganese and zinc) were greatly enhanced particularly as WEFASAN application rate increased; 1000 and 1500 cm^3/feddan proved to be superior. The response was more obvious in case of problemed soils (sandy and calcareous) particularly when treated with any of soil amendments, compost being more suitable than bentonite.

Obtained findings may reveal a promising role for WEFASAN application nots only in decreasing irrigation requirements but also in improving conditions responsible for nutrient availability in soils particularly those of poor fertility conditions. In this concern, obtained data (Table, 1) clearly showed that WEFASAN application has a major role in maximizing the activity of soil amendments in both of keeping soil moisture and enhancing soil fertility. Combinations of WEFASAN at rate of 1000 or 1500 cm^3/feddan with compost yielded the superior response.

II- Response of Tomato Plants

Tomato (Lycopersicum *esculentum* cv. Faculta) plants grown on calcareous soil (at the Delta West region) were treated with five doses of WEFASAN (0, 500, 1000, 1500 and 2000 cm^3/feddan) 21 days from transplanting with (+) or without (-) pesticide application to manifest the response of tomato plants not only to WEFASAN application but also to the interactive role(s) of pesticides on the WEFASAN activity. Tomato growth was evaluated at the beginning of fruiting stage where the newest full expanded leaf was analyzed for determining the nutritional status of the tomato plants.

Obtained data (Table, 2) showed that WEFASAN application increased tomato growth whether applied with or without pesticide; the effect was superior when WEFASAN was applied far from pesticides. Nutritional status was also improved as contents of N, P and K (representing macronutrients) as well as Fe, Mn and Zn (representing micronutrients) was improved. Generally, WEFASAN dose of 1000 followed by 1500 cm^3 /feddan was found to be the most superior one for enhancing growth and nutritional status of grown tomato plants.

Obtained trend for the response of growth and nutritional status reflected on tomato fruit yield whose found to be positively responded to application of WEFASAN whether with or without pesticides. This is true in spite of the superiority of application far from pesticide spraying. Rates of 1000 and 1500 cm^3 /feddan proved again to be the superior treatments. This is true when early, total and/ or early % are taken in consideration.

III- Response of Corn Plants

Corn (*Zea mays L,* c.v. Giza 2) plants grown on sandy soil (Delta East region) were sprayed at the 4th leaf phase with 1000 cm^3 WEFASAN /feddan under different NPK fertilization conditions as interacted with addition of 1 % bentonite or compost to the cultivated soil. Corn growth was evaluated at the beginning of ear formation. Ear leaf was analyzed to evaluate the response of nutritional status to WEFEÿASAN application.

Obtained data (Table, 3) indicated that WEFEÿASAN application increased corn growth whether expressed as dry weight of whole plant or the ear leaf. The activating role observed for WEFEÿASAN application was found to be maximized as the rate of fertilization increased. So the maximum benefit for WEFEÿASAN application was recorded under the most rich fertilization conditions.

Obtained yield proved the previous encountered action of WEFASAN application whether straw or ear yield was taken in consideration. Of course, such obtained trend could be related to the improvement in the nutritional status of both macro and micronutrients in the grown plants as shown in Table (3). Speculating data of nutritional status revealed that WEFASAN application improved not only nutrient content in the indicator (ear) leaf but also strongly increased the uptake of such nutrients by plants may be due to activating the growth of plant roots as well as increasing the soil fertility conditions leading to some increases in fertilizer use efficiency.

As expected, although bentonite and compost treatments enhanced the corn growth, nutritional status and subsequently obtained yield, WEFASAN application proved to have some good interaction relations with the use of such soil amendments (bentonite and compost) as well as the handled fertilization rate. The highest crop response was obtained from combining WEFASAN with compost particularly at higher fertilization rates. From obtained figures representing growth and yield, Table (3), it could be concluded that WEFASAN application maximizes both benefits of soil amendments and efficiency of added fertilizers.

Finally, from data representing the response of soil and plant to WEFASAN application, some promising treatments could be recommended to improve soil characteristics particularly those related with its fertility status. Levels of 1000 and 1500 cm^3 /fed proved to be the superior treatments. Superiority of them, however, depends on the soil type and /or the used soil amendment. Data representing plant growth and nutritional status revealed that 1000 and 1500 cm^3 WEFASAN/feddan were superior for both tomato and corn crops. However, some further studies could be conducted to verify plant response to the most promising treatments of WEFASAN under different conditions particularly those dealing with irrigation regime and phase of WEFASAN application (plant growth stage). Such studies will maximize the WEFASAN action to make the recommendation of present work more common, fruitful and confident particularly when carried out for other crops. I suggest wheat and bean as food crops as well as cucumber and pepper as vegetable ones along with some fruit crops like banana, mango, and citrus varieties.

The visor of evaluation process

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Table (1): Effect of WEFASAN application on some physical and chemical properties of different soils amended with certain soil conditioners and incubated for 90 days at irrigation level of 60% field capacity.

Soil type	1% conditioner application	WEFASAN application rate (cm^3/fed)	pH	EC mS/cm (1:5 extract)	Organic matter %	Structure factor	Available nutrients (ppm)						Irrigation water consumed for 90 days cm^3/kg soil
							N	P	K	Fe	Mn	Zn	
Sandy	None	0	8.20	0.17	0.11	4.2	07.2	3.09	98	20.0	10.7	1.50	428
		500	8.22	0.20	1.05	4.7	10.5	3.11	146	22.6	11.4	1.75	396
		1000	8.27	0.28	1.20	5.2	14.1	3.12	165	25.2	13.0	1.80	374
		1500	8.31	0.37	1.32	5.6	19.3	3.15	184	25.8	15.5	1.90	350
	Bentonite	0	8.14	0.19	1.05	5.1	06.9	3.20	138	26.0	10.8	1.75	451
		500	8.20	0.19	1.45	7.2	10.1	3.25	172	30.0	10.8	2.00	426
		1000	8.28	0.28	1.56	7.8	14.2	3.27	196	43.2	11.6	2.10	404
		1500	8.34	0.35	1.77	8.1	18.9	3.38	210	45.5	12.8	2.50	371
	Compost	0	8.02	0.21	2.41	8.9	20.1	4.97	202	20.0	9.5	4.50	420
		500	8.00	0.29	2.81	10.6	26.7	5.03	233	31.5	11.6	6.70	392
		1000	8.00	0.38	3.05	10.9	28.3	5.14	251	32.5	14.4	6.82	370
		1500	7.93	0.49	3.09	11.8	30.2	5.56	272	33.5	16.1	7.50	343
Calcareous	None	0	7.95	0.83	0.92	57.5	74.9	5.31	205	13.5	29.8	5.00	701
		500	8.01	0.91	1.13	59.1	77.7	5.48	220	15.7	31.2	5.50	675
		1000	8.10	0.99	1.25	61.3	80.0	5.50	298	17.3	31.4	5.87	651
		1500	8.17	1.08	1.36	63.3	83.3	5.53	319	18.8	34.0	6.21	631
	Bentonite	0	8.05	0.85	1.31	52.5	74.9	5.41	285	15.6	28.3	5.20	708
		500	8.13	0.99	1.54	54.4	78.1	5.49	307	16.9	29.8	5.55	686
		1000	8.22	1.12	1.64	56.1	80.8	5.52	321	18.7	31.8	6.12	666
		1500	8.24	1.22	1.87	55.8	84.4	5.57	342	19.8	34.6	6.87	643
	Compost	0	7.43	1.03	2.72	56.1	79.9	5.88	318	15.3	31.0	6.50	689
		500	7.54	1.18	2.91	58.9	83.5	6.12	342	19.2	37.0	6.89	658
		1000	7.67	1.23	2.98	62.0	86.1	6.30	364	21.3	38.7	7.35	631
		1500	7.77	1.29	3.11	65.3	93.2	6.32	390	22.5	49.6	7.84	616
clayey	None	0	7.22	0.88	1.11	54.9	93.4	10.8	315	31.2	30.9	10.0	886
		500	7.34	0.98	1.35	58.8	98.6	11.9	331	32.5	35.0	11.1	854
		1000	7.39	1.12	1.39	63.1	110.1	11.9	350	43.0	39.1	16.5	832
		1500	7.43	1.19	1.50	69.7	129.0	12.1	379	46.1	41.9	17.6	812
	Bentonite	0	7.58	0.91	1.70	62.1	94.1	10.9	377	35.0	28.9	10.0	896
		500	7.69	0.99	2.19	68.5	97.9	11.8	392	37.5	35.0	13.2	862
		1000	7.75	1.12	2.54	70.6	108.9	11.9	408	40.0	47.5	15.0	826
		1500	7.83	1.19	2.83	76.9	117.6	12.3	432	44.2	49.5	18.5	768
	Compost	0	7.09	1.03	3.50	66.6	108.8	11.3	408	40.0	39.7	09.5	858
		500	7.13	1.10	4.12	72.0	114.3	12.4	416	42.0	47.2	09.7	823
		1000	7.20	1.18	4.53	76.2	120.2	12.6	448	45.7	48.5	16.0	788
		1500	7.28	1.26	4.48	79.8	128.0	13.5	476	48.8	48.7	18.2	768

Table (2): Effect of WEFASAN application, foliary sprayed with or without pesticides, on growth and nutritional status of tomato plants grown on calcareous soil.

WEFASAN application rate (cm^3/fed)	Pesticide application	Number of leaves/ plant	Dry weight of newest full expanded leaf (g)	Nutritional status of newest full expanded leaf												Fruit yield (kg/fed)	
				Concentration						Uptake							
				N	P	K	Fe	Mn	Zn	N	P	K	Fe	Mn	Zn	early	Total
				(%)			(ppm)			(mg/leaf)							
0	-	28	5.59	3.83	0.19	3.62	234	30.2	19.2	228	11	215	1.31	0.17	0.11		
	+	26	5.10	3.89	0.15	3.72	218	38.5	29.1	198	08	190	1.11	0.19	0.15		
500	-	38	7.32	5.11	0.27	4.42	246	47.5	23.7	379	20	324	1.80	0.35	0.17		
	+	33	6.58	4.76	0.24	3.12	227	42.0	24.4	317	16	205	1.49	0.28	0.16		
1000	-	42	8.46	5.32	0.33	4.14	436	77.4	31.0	451	28	350	3.69	0.65	0.26		
	+	35	6.24	5.11	0.26	2.82	305	58.5	29.9	314	16	176	1.90	0.37	0.19		
1500	-	44	7.94	4.86	0.39	4.70	366	46.0	32.4	386	31	373	2.91	0.37	0.26		
	+	35	6.93	4.37	0.23	2.40	329	40.0	28.0	304	16	166	2.28	0.28	0.19		
2000	-	39	7.18	4.47	0.29	4.33	488	43.0	23.5	324	21	311	3.50	0.31	0.24		
	+	31	6.12	4.19	0.24	3.77	244	41.0	31.7	262	15	228	1.49	0.25	0.19		

Table (3): Effect of WEFASAN application on growth and nutritional status of corn plants grown on sandy soil and fertilized with different NPK levels.

*Fertilizer application rate N P K	1% conditioner application	Dry weight (g)		Nutritional status of the ear leaf												Yield	
				Concentration						Uptake							
		Whole plant	ear leaf	N	P	K	Fe	Mn	Zn	N	P	K	Fe	Mn	Zn	Straw	ears
				(%)			(ppm)			(mg/leaf)			(μg/leaf)			(kg/fed)	
1 1 1 without WEFASAN	None	48.3	2.41	2.19	0.14	2.06	236	14.1	17.8	53.8	3.37	49.6	569	33.9	43.0	1512	1415
	Bentonite	50.6	2.45	2.05	0.15	2.17	257	18.7	16.5	50.2	3.68	53.2	630	45.8	40.4	1568	1735
	Compost	69.9	2.63	2.23	0.18	2.31	245	19.8	19.3	58.6	4.73	60.8	644	52.1	50.8	2156	1834
1 1 1 with WEFASAN	None	58.5	3.35	2.21	0.15	2.45	241	21.3	18.5	74.1	5.03	82.8	807	71.4	62.0	1932	1617
	Bentonite	81.6	3.51	2.27	0.17	2.53	258	22.5	18.1	79.7	5.97	88.8	906	79.0	63.5	2716	1892
	Compost	96.4	3.72	2.32	0.22	2.59	260	24.3	19.8	86.3	8.18	96.3	967	90.3	71.1	3220	1940
2 2 2 without WEFASAN	None	81.7	2.73	2.45	0.21	2.31	227	22.3	23.1	66.9	5.73	63.1	620	60.9	63.1	2632	1670
	Bentonite	110.1	2.91	2.56	0.23	2.35	245	24.1	26.8	74.5	6.69	68.4	713	70.1	78.0	3528	1864
	Compost	112.4	3.47	2.73	0.24	2.73	295	19.8	24.5	94.7	8.33	94.7	1023	68.7	85.0	3584	1870
2 2 2 with WEFASAN	None	94.3	3.75	2.73	0.21	2.65	215	20.0	21.6	102	7.88	99	806	75.0	81.0	3668	1884
	Bentonite	128.4	3.92	3.08	0.25	2.92	237	19.5	23.7	121	9.80	114	929	76.4	92.9	5012	2117
	Compost	132.5	4.22	3.41	0.29	3.14	249	22.3	22.5	144	12.24	133	1051	94.1	95.0	5152	2075
3 3 3 without WEFASAN	None	96.1	2.83	2.95	0.23	3.15	236	18.6	19.8	83	6.51	89	668	52.6	56.0	3360	1835
	Bentonite	117.3	2.98	3.11	0.23	3.27	241	23.1	21.3	93	6.85	97	718	68.8	63.5	4088	1957
	Compost	119.6	3.49	3.37	0.25	3.35	237	21.8	20.4	118	8.73	117	827	76.1	71.2	4144	2025
3 3 3 with WEFASAN	None	144.6	3.82	3.47	0.26	3.27	253	23.3	21.3	133	9.93	125	966	89.0	81.4	5236	1915
	Bentonite	157.3	4.12	3.62	0.27	3.35	271	24.1	21.7	149	11.12	138	1117	99.3	89.4	5712	2300
	Compost	162.1	4.16	3.68	0.31	3.42	282	2.25	19.5	153	12.90	142	1173	93.6	81.1	5880	2351

* $N_{1,2,3}$ = 100 , 150 and 200 kg N/fed.
$P_{1,2,3}$ = 20 , 40 and 60 kg P_2O_5/fed.
$K_{1,2,3}$ = 50 , 70 and 90 kg K_2O/fed.