

EFFICACY TESTS OF OTTO O.A.S.E. WATER RETAININGS FOR SOILS AND GROWING MEDIUM

**Client: ADVANCED NEW WATER TECHNOLOGIES (ANWT).
GmbH & Co.KG**



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Introduction

Since April 2013 a series of efficacy tests of water retainings (OTTO O.A.S.E.) for soils and growing media of the ADVANCED NEW WATER TECHNOLOGIES (ANWT) GmbH & Co. KG company has been carried out.

The main goal of the work was to verify the effectiveness of the water retainer on a referential plant species in mitigating stress deriving from a limited availability of water.

Materials and methods

Three trials were carried out in greenhouse made out of iron and glass on raised benches. Irrigation was carried out for each plant with a microflow irrigation system provided with an electronic valve for each treatment.

The irrigation system was controlled by a special control unit according to the water requirements foreseen by the protocol.

Each treatment was replicated three times and each replication was composed by 4 plants.

The plant species used for trials was Petunia, being a plant species suffering from water stress, grown in a black polypropylene pots, 14 cm diameter.

In two trials a peat substrate characterized by high porosity and low water retention was used, while in a third trial, carried out together with the other one, a sandy substrate was used.

Two fertilizers were tested, a mineral (ternary compound) and an organic one (humic acid).

The protocol was designed in order to combine increasing rates of the water retaining OTTO O.A.S.E. with lower doses of water together with increasing rates of mineral fertilizer and humic acid.

Water dosage used during the trial:

1. the volume considered normal for the development of Petunia was equal to 50 ml/day, for the initial development stage of young plants (first week of cultivation), to 100 ml/day from the 8th to the 20th day of the crop cycle and to 200 ml/day after the 20th day until the end of the cultivation.

2. Reduced rates of water with regards to the amount considered normal or “as reference” for the crop were:

- a. 50% of the maximum amount
- b. 25% of the maximum amount

The microflow irrigation system was set up accordingly to a specific management software.

Figure 1 shows the beginning of the trials, with the positioning of the different water treatments.

Figure 2 shows the first stage of petunia crop cycle.

Figure 3 shows trials at 2/3 of petunia crop cycle.

During trials the following parameters were recorded:

- Chlorophyll content in leaves (Fieldsout, Chlorophyll Meter CM 1000)
- Plant diameter (cm)
- Biomass produced (g/plant)
- Total number of flowers produced (number)
- Quantity of water retained in the growing medium at increasing doses of the water retaining OTTO O.A.S.E. at initial and final phases of the trial (weight).

Figure 1. Beginning of the trials

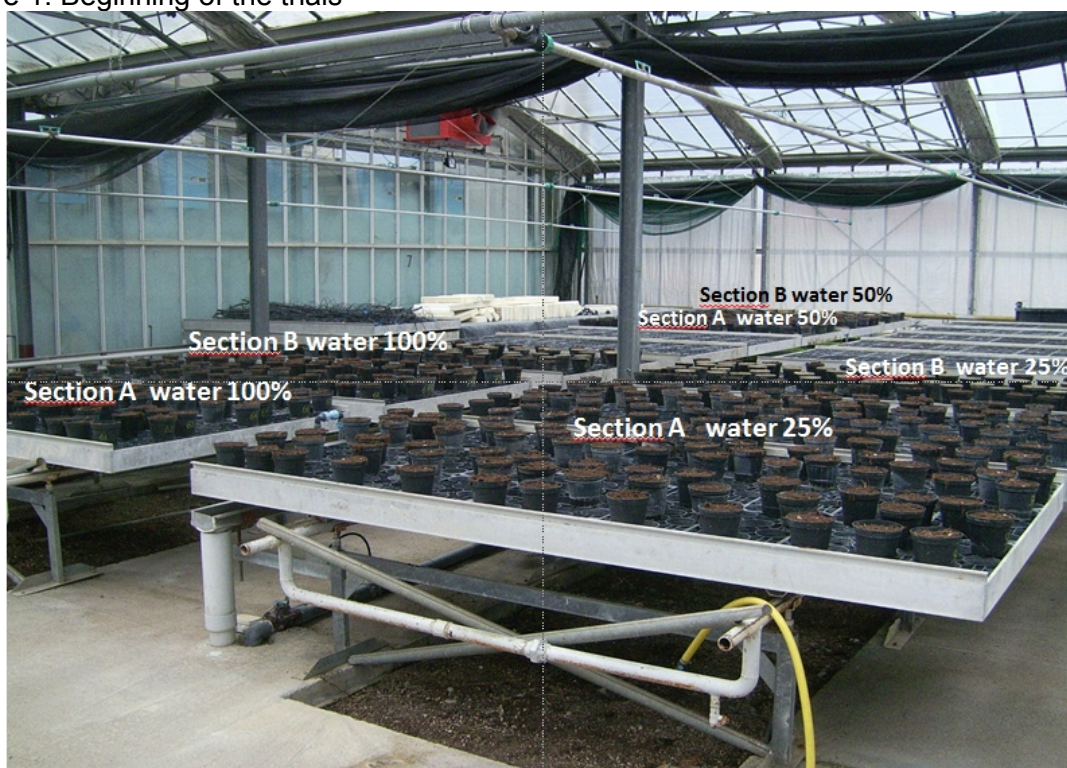


Figure 2. Trials with the water retaining OTTO O.A.S.E. at about 1/3 of the petunia crop cycle



Figure 3. Trials with the water retaining OTTO O.A.S.E. at about 2/3 of the petunia crop cycle



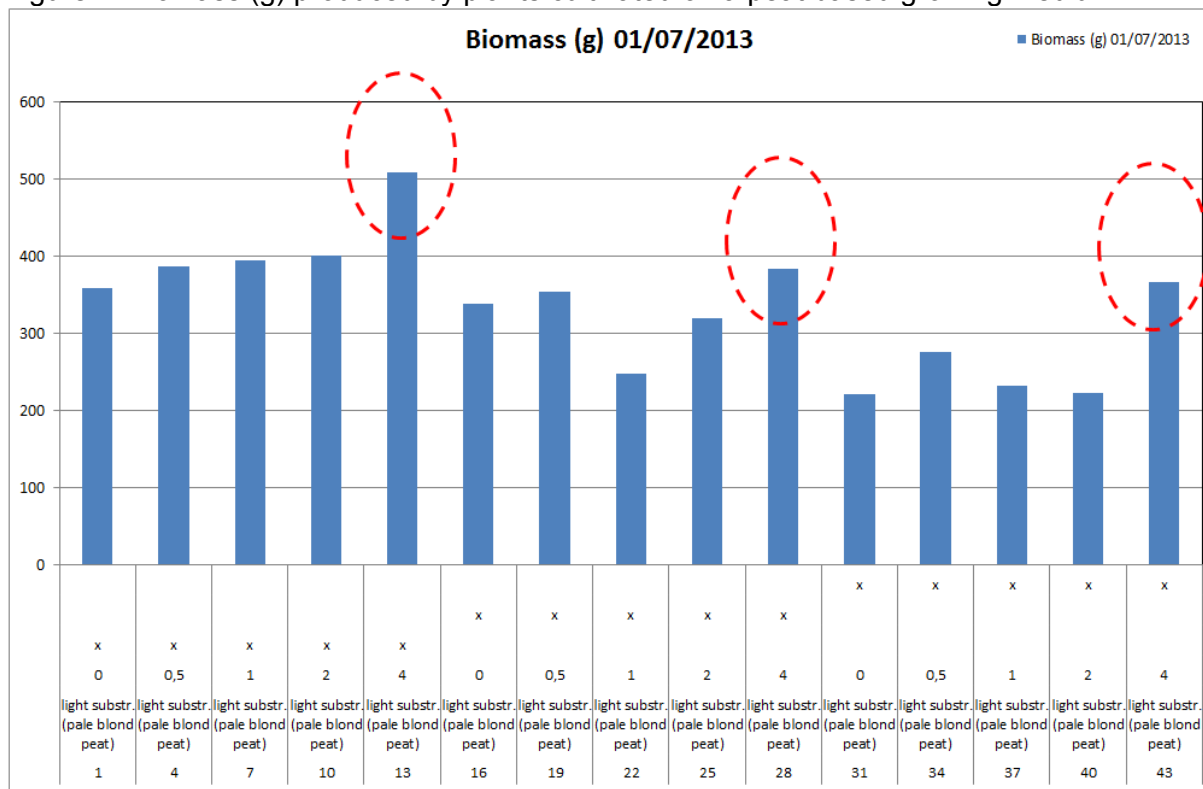
Results and data evaluation

DIRECT EFFECTS ON THE CROP

Trials carried out showed that chlorophyll content increases significantly at increasing rates of the water retaining mixed together with the growing medium when normal water volumes are provided to the crop.

When the maximum dosage of the water retaining OTTO O.A.S.E. is used, biomass (fresh weights of plants) increases in a statistically significant way (Figure 4). The same behavior is constantly observed when ideal water volumes are provided to the crop as well as with volumes reduced by 50% and 70%.

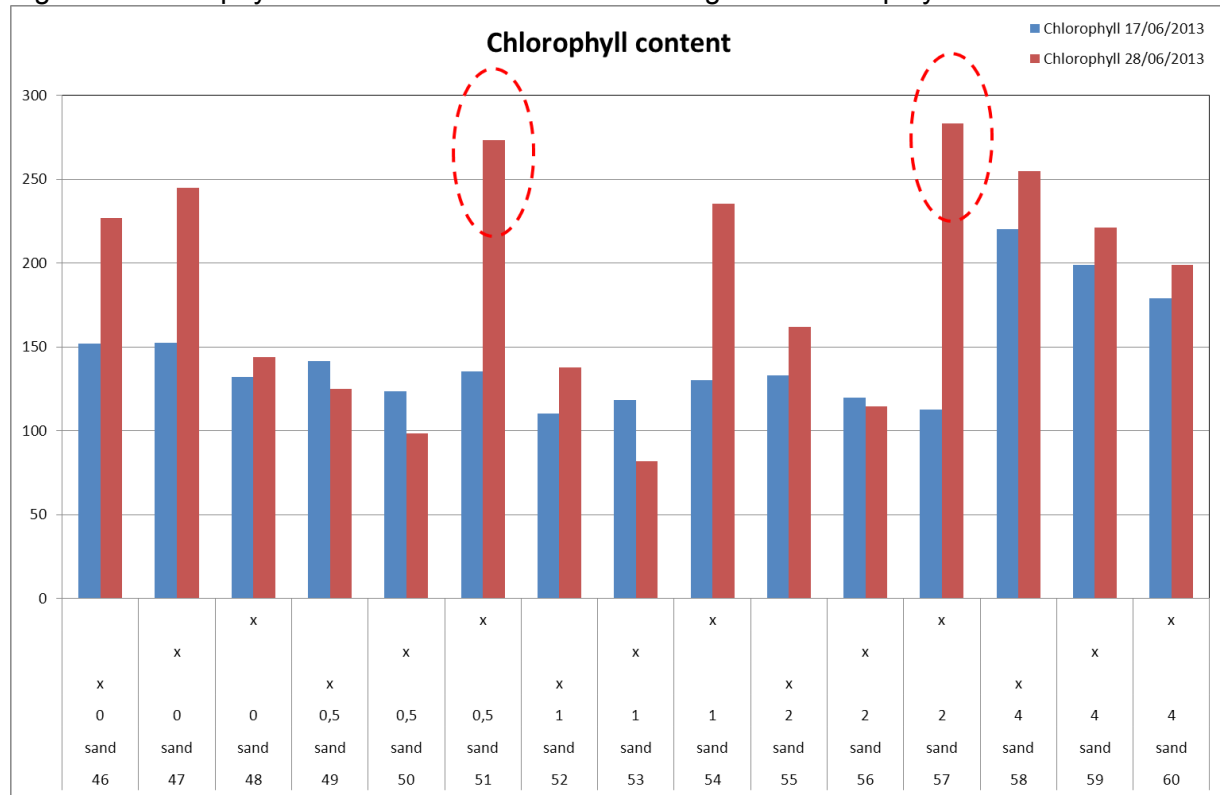
Figure 4. Biomass (g) produced by plants cultivated on a peat based growing medium.



The effect of water retaining at all the dosages tested (0.5, 1, 2% v/v of the growing medium) on chlorophyll content (Figure 5) was clear and constant when reduced volumes of water (25% of the optimal dose for the crop) were applied and when plants were grown on a 100% sandy growing medium that can be considered averagely poor in nutrients.

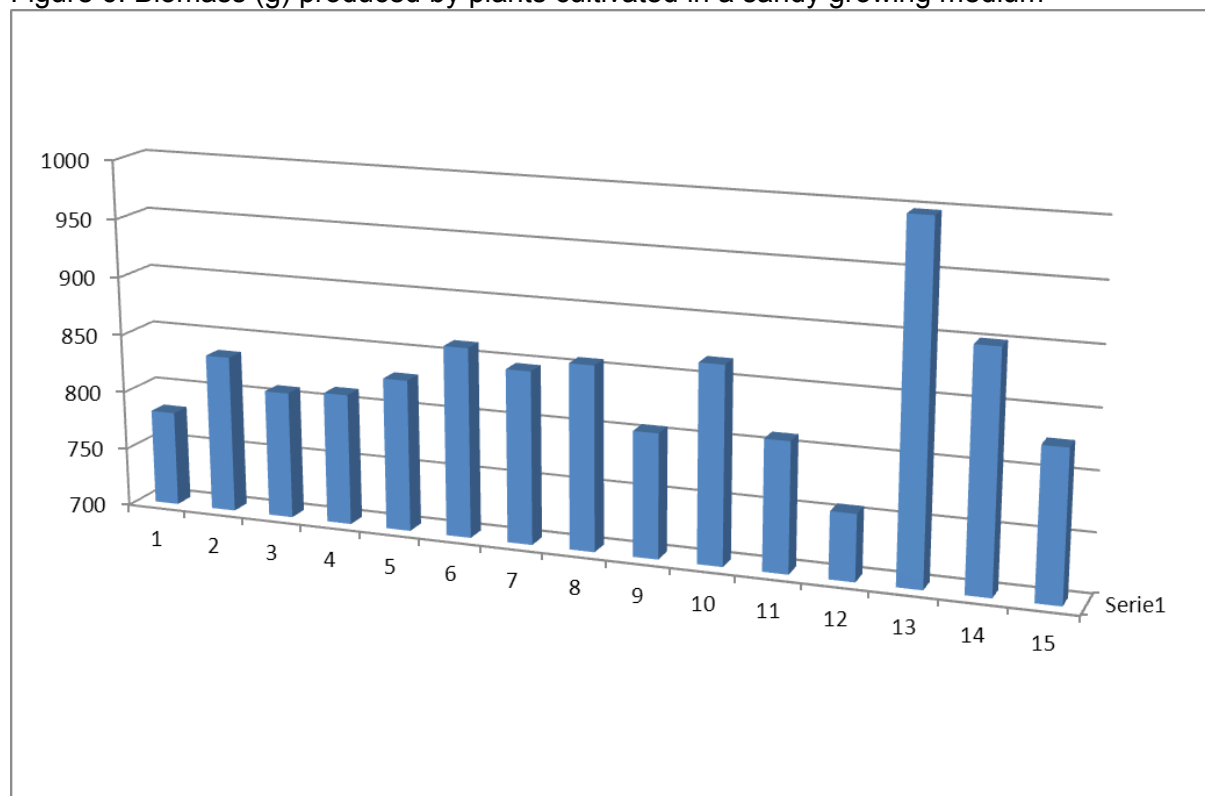
It has to be stressed that all the plants grown on a sandy growing medium had a mediocre external appearance due to the very low input of nutrients that was deliberately provided to them.

Figure 5. Chlorophyll content of leaves at different stages of the crop cycle.



Even when a poor (from a nutritional point of view) growing medium was used an increase of plant biomass production was observed at increasing dosages of the water retaining OTTO O.A.S.E. (Figure 6), although the effect of the product was not always clear when considered in combination with water supply and such behavior is related to the quality of the initial growing medium.

Figure 6. Biomass (g) produced by plants cultivated in a sandy growing medium



EFFECTS ON BIOMASS PRODUCTION

Experimental trials carried out during summer 2013 showed that the most interesting results were related to biomass production.

Weight of plants – in terms of fresh matter (biomass) produced - grown in growing media provided with no fertilizer, increasing quantity of water retaining and decreasing amounts of water was higher when the highest doses of the water retaining were applied (Table 1).

Table 1. Average weight per plant (g) grown at increasing dosage of water retaining and decreasing dosages of water.

Water retaining dosage (%)	0	4	weight increase (%) 0-4%
water 100%	358	508	41,8
water 50%	339	384	13,2
water 25%	221	367	65,9

Giving index 100 to the weight of biomass produced by plants grown in standard conditions with regards to water volumes provided (100 % of the water needed) and in absence of fertilizer and water retaining, the weight increase - expressed as percentage - was assessed for the different treatments.

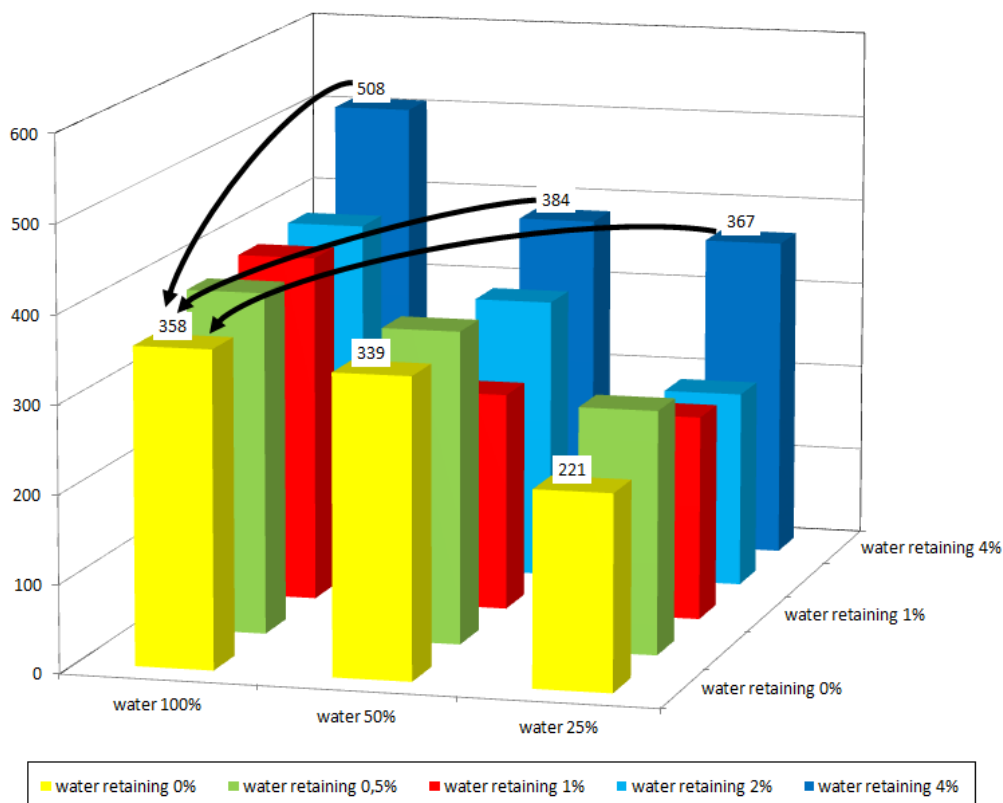
Biomass produced by plants cultivated using a growing medium with a water retaining dosage equal to 4% v/v and at all irrigation water dosages considered has been constantly higher than the biomass produced by plants grown in standard conditions (100% of water needs and absence of the water retaining).

In the table below (Table 2) the change (%) in the biomass produced with regards to a reduction in water availability and in presence of increasing dosages of the water retaining (100 basis points are given by 0% water retaining and by 100% water supply) is shown.

Table 2. Change (%) of the produced biomass depending on the reduction of the water supply and at increased dosages of water retaining (100 basis points are given by 0% water retaining and by 100% water supply)

	water retaining 0%	water retaining 4%
water 100%	100	41,8
water 50%	-5,4	7,1
water 25%	-38,3	2,4

Figure 7. Average weight of plants at increasing dosage of water retaining and decreasing dosage of water.



Results showed that at a lower level of water availability and in the absence of the water retaining a strong decrease in the biomass produced is observed. This decline is mitigated by the presence of higher doses of the water retaining (Figure 7).

WATER RETENTION CAPACITY OF THE WATER RETAINING ADDED TO A GROWING MEDIUM

At the beginning of the crop cycle, the effect of the water retaining OTTO O.A.S.E. on the water-holding capacity of the growing medium was extremely evident, even at very low dosages of the water retaining OTTO O.A.S.E. (0,5% V/V) (Table 3).

Table 3. Weight of the growing medium at the beginning of the crop cycle (g)

Treatment	Water retaining (% vol)	Weight of the growing medium mixed with the water retaining OTTO O.A.S.E.	Weight of the growing medium at the maximum water-holding capacity	Weight increase (%)	Absolute difference in weight
1	0	0,6	1,3	216,7	0,7
4	0,5	0,6	1,7	283,3	1,1
7	1	0,6	1,55	258,3	0,95
10	2	0,6	1,65	275	1,05
13	4	0,5	1,15	230	0,65

This effect was no longer visible at the end of the crop cycle; probably a regular supply of the water retention could actively contribute to maintain both a high water-holding capacity and the positive performances pointed out with this trial.

CONCLUSIONS

OTTO O.A.S.E. water retaining lead to positive results in plant production, it did not show phytotoxicity effects and it did not interacted negatively with the roots of the growing plants.

In brief, we can state the following:

1. OTTO O.A.S.E. water retaining allows to retain a bigger quantity of water in the growing medium with respect to the normal conditions of the water retention capacity. The best mixing rate of the water retaining OTTO O.A.S.E. with the growing medium should be at least equal to 4% vol/vol. The increased water availability in the soil-growing medium complex can lead to:
 - a. mitigation of temporary or continuous water shortages;
 - b. capacity to sustain a constant development of the plant, even in the presence of a reduced water availability;
 - c. maintenance of constant and high productive performances, in terms of biomass, comparable with those of plants grown under normal conditions of water availability.
2. The best performance of the water retaining OTTO O.A.S.E. occurred in the presence of: 1. a water availability optimal for the crop and 2. a reduction of the water availability equal to the 50% of the ideal amount for that crop;
3. It is possible, thanks to the use of the water retaining OTTO O.A.S.E., to reduce the need of irrigation water up to 50% of the normal dosage for the crop, thus maintaining a good weight increase;
4. A low availability of the irrigation water (25% of the normal need for the crop) does not affect biomass production capacity of the tested plants compared to plants grown in the

growing medium without water retaining, but the commercial value of plants tends to decrease strongly;

5. In the presence of an optimal water supply, a weight increase in biomass equal to 40% was observed when the growing medium was mixed with a 4% vol/vol of water retaining.

When progressively decreasing the contribution of water, weight increase observed with respect to the best growing conditions without water retaining, decreased, despite being higher compared to the best results obtained without water retaining.

6. The water retaining OTTO O.A.S.E. created good conditions in the growing medium for roots growth.

Operative hints

It is necessary, during the first irrigation after having mixed the water retaining OTTO O.A.S.E. with the growing medium, to distribute a water quantity higher than the normal one for the crop in order to ensure a complete uptake of water by the water retaining OTTO O.A.S.E. itself.