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REVIEW ARTICLE

Results obtained with EVOagri technology to improve yield using filtered water in Africa, Tibet, Italy and Bulgaria

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Abstract

The effectiveness of the application of EVOagri technology for purification of water and its use in agriculture in some African countries (Zimbabwe, Burundi, Egypt and Uganda), Nepal (Asia) and in Europe (Italy and Bulgaria) was evaluated. The performance of EVOdrop turbine for water filtration was analysed and the physicochemical composition of water was tested. This was determined in compliance with Ordinance No. 9/2001, published in the Official State Gazette, issue 30, and decree No. 178/23.07.2004, Bulgaria, European Union on the quality of water intended for drinking and household purposes. The results showed a significant increase in production yield of the tested *Solanum* spp. and lettuces in Zimbabwe, as well as of dill, spinach and onions in Egypt. Treatment of high-salt irrigation water in Burundi with EVOagri reduced its toxic effect upon vegetable plants. In Uganda, plants absorbed 23% less water, when filtered with EVOagri technology. In Italy, 21% water conservation was achieved through the usage of EVOagri technology. Stimulation of seed-germination after soaking with EVOagri water was established in Burundi and Nepal. The importance of the type and composition of irrigation water for crop growth was proved by the experiments in Bulgaria. In Bulgaria, onion seeds were planted in two separate pots. The first one was watered with tap water and this was taken as the control sample with tap water. The second one was watered with EVOdrop filtered water which was saturated with EVOdrop hydrogen technology (EVOwater). In Bulgaria, under natural conditions, Evodrop water was also tested in beans and the growth result was 11 % better than the control sample.

Keywords

EVOdrop technology, water filtration, Africa, Nepal, Italy, Bulgaria

Introduction

One of the most pressing issues of our time, in the context of global warming, is the supply of water to the agrarian regions of Africa, as well as in other regions of the world. This is also related to the problem of scarcity of food as it can have an aggravating effect on it. Not only the quantity of water but also its quality, is important, as salinity often reaches up to 4200 ppm or 4195 mg.L^{-1} (1). The use of such water for irrigation negatively affects the quantity and quality of agricultural production. In search of a solution to this problem, research was conducted during 2020-2021 regarding filtration of water using the patented EVOdrop technology from Switzerland, in Zimbabwe, Burundi, Uganda, Egypt in Africa and in Nepal (Asia). Research was carried out by Bundura University of Science Education, Zimbabwe (2), Higher Institute of Business Management, Republic of Burundi (3), General Authority for Agrarian Reform, Ministry of Agriculture and Land Reclamation, Egypt (4), Makerere University, Uganda (5), and Agriculture and Forestry University, Nepal (6).

Studies about rainwater filtration was also conducted in Bulgaria. Alkalization of the water with EVOdrop turbine was confirmed. Plants were watered under laboratory conditions in order to prove changes in growth parameters. In Bulgaria, the research was performed in accordance with Ordinance No. 9/2001, Official State Gazette, issue 30, and Decree No. 178/23.07.2004 regarding the quality of water for consumption and domestic uses and household purposes (7-9).

The objective of the present work was to evaluate the effectiveness of the application of EVOagri technology for purification of waters and their use in agriculture in some African countries, Bulgaria, Italy (Europe) and Nepal (Asia).

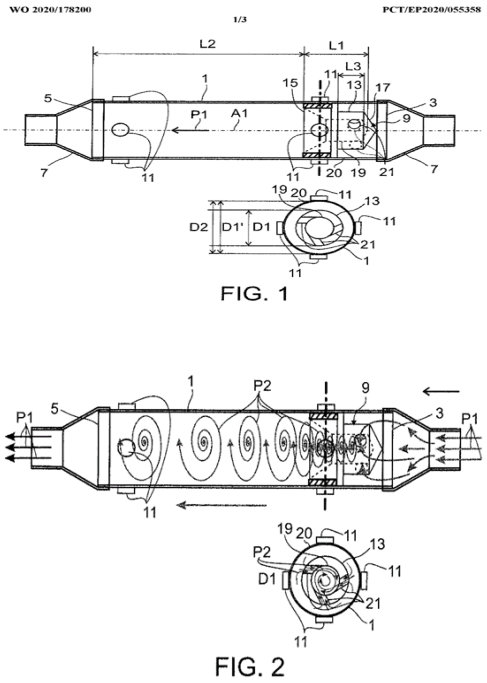

Fig 1 and 2. EVOdrop turbine operation principle.

Fig 3. EVOdrop filter.

Materials and Methods

EVO drop turbine water purifier

The proprietary operating principle and developed geometry of EVOdrop turbine is represented in Fig. 1, 2, 3. It enables a very efficient treatment for water. Incoming water passes through a rotating turbine, driving it with its pressure, through the rotating device at over 10000 rpm in relation to 60 litres/minute flow and 4 bar water pressure. Specific outcomes of such treatment are based on magneto-hydrodynamic forces (10, 11). Fig 1 and 2 show EVOdrop turbine operation principle. .

Methods for physicochemical analysis

The physicochemical composition of water from springs and other sources was analysed, to know whether it is in compliance with Ordinance No. 9/2001, Official State Gazette, issue 30, and decree No. 178/23.07 004 about the quality of water intended for drinking and domestic purposes (7-9).

The following methods were adopted for determination of various parameters:

color according to Rublyovska Scale – method by Bulgarian State Standard (BDS) 8451: 1977;

smell at 20°C – method BDS 8451: 1977 using technical device glass mercury thermometer, conditions No. 21;

turbidity – EN ISO 7027, technical device turbidimeter type TURB 355 IR ID No. 200807088;

pH – BDS 3424: 1981, technical device pH meter type UB10 ID NoUB10128148;

oxidizability – BDS 3413: 1981;

chlorides – BDS 3414: 1980;

nitrates – Validated Laboratory Method (VLM)-NO_3-No. 2, technical device photometer "NOVA 60 A" ID No. 08450505;

nitrites – VLM NO_2-No. 3, technical device photometer "NOVA 60 A" ID No. 08450505;

ammonium ions – VLM-NH_4-No. 1, technical device photometer "NOVA 60 A" ID No. 08450505;

general hardness – BDS ISO 6058;

sulfates – VLM-SO_4-No. 4, technical device photometer "NOVA 60 A" ID No. 08450505;

calcium – BDS ISO 6058;

magnesium – BDS 7211: 1982;

- phosphates – VLM-PO_4-No. 5, technical device photometer "NOVA 60 A" ID No 08450505;

- manganese – VLM-Mn-No. 7, technical device photometer "NOVA 60 A" ID No 08450505;

- iron – VLM-Fe-No. 6, technical device photometer "NOVA 60 A" ID No. 08450505;

- fluorides – VLM-F-No. 8, technical device photometer "NOVA 60 A" ID No. 08450505;

- electrical conductivity – BDS EN 27888, technical device – conductivity meter inoLab cond 720 ID No 11081137.

Countries

Research has been conducted with EVOagri technology using EVOdrop turbinein the following countries – Zimbabwe (2), Burundi (3), Egypt (4), Uganda (5) in Africa, in Nepal (6), (Asia), and in Italy and Bulgaria (Europe). Waters, with salinity levels of 4200 ppm or 4195 mg.L^{-1}, was filtrated.

Results & Discussion

The main results of research conducted with different plants is given below, with respect to the countries where the testing was done.

Africa

Zimbabwe -

The production yield of *Solanum* varieties (nightshade spp.) increased from 7 to 13 %. The leaf size of local lettuce variety (*Lactica sativa* L.) increased by 36% and the total weight increased from 124 g. per lettuce to 171 g.This represents a 37% increase in weight gain. Researchers expect a further increase with longer use of EVOagri (2).

Burundi

An increase in the yield from 19.4 to 23.1% was proven. The irrigation water with a high salt content was subjected to EVOagri treatment to reduce the toxic effect on vegetable plants. Total plant productivity using saline water for irrigation was reduced by 9.7 to 25.3 % (3).The researchers recommend to soak the seeds in EVOagri water up to 12 hours before sowing.

Egypt

There were positive results with the application of EVOagri technology in cultivation of dill (*Anethum graveolens* L.), spinach (*Spinacia oleracea* L.) and onions (*Allium cepa* L.) (4)

Uganda

Experiments proved that plants absorb 23% less water, when filtrated with EVOagri technology. A valuable result is that the use of fertilizers was reduced by 27% (5).

The images show the application of EVOagri technology in Africa are presented in Fig. 4 a, b.

Fig. 4. Application of EVOagri technology in Africa.

Asia

Nepal

Germination effects are studied by soaking the seeds with EVOagri technology. When soaking tomato seeds, germination was found to be 1.2 to 2.8 times faster with water filtered by the EVOagri technology than with control water. These are 2-3 days earlier than expected. During an experiment with two containers with mustard seeds, a 14% better result was observed when using EVOagri water (6).

Europe

Italy

Research in Italy revealed a 21% water saving through the usage of EVOagri technology. The project included tests on olive trees for production of organic olive oil in Sicily, Italy, over 18 months. The incoming water has a salt content of 1100 ppm. The researchers reported a problem of impossibility of organic farming, here.

Bulgaria

In 2010, Ignat Ignatov conducted some tests with students of the Club of Medical Biophysics, Georgi Benkovski Secondary School, town of Teteven, Bulgaria. Seeds of *Zea mays* L. were watered with two different types of water. In all experiments the plants treated with spring mountain water had better growth than those treated with tap water (Fig. 5). The average result when comparing height was 27.5 cm for the plants treated with mountain spring water, and 23.2 cm for those with tap water. The difference was 15.6 % (12).

Experiments conducted with EVOagri water show an improvement of physiological parameters of seeds and plants (2-6).

In 2022, research was carried out in Sofia, Bulgaria with EVOdrop treated water. Onion seeds, 15 in number, were planted in two separate pots. The first one was watered with tap water. This was used as the control sample. The second pot was watered with EVOdrop

Fig. 5. Results with corn seeds of *Zea mays L.*

filtered water which was saturated with EVOdrop hydrogen technology called EVObooster. This water was saturated with EVOdrop hydrogen technology with pH=7.3; ORP=-390 mV; concentration of Hydrogen (H_2) 1.2 ppm. The control sample was with solute concentration 168 ppm. The sample was filtered from tap water with EVOdrop technology and was with 7 ppm. There were performed 10 measurements and the results are statistically significant with t-test of Student ($p<0.10$). The results were achieved with EVOdrop filtered device with *Haberlea rhodopensis* Friv (13). The effects of hydrogen (H_2) were described in (14)

Table 1and Fig. 6 illustrate the results obtained with onion seeds (15th day), watered with tap water (control sample), EVOdrop filtered water, saturated with EVOdrop hydrogen technology (sample). The result showed that there are 15 sprouts in the sample pot and only 5 with the control pot. The difference between the results estimated with t-test of Student was significant ($p<0.05$).

Table 1. Results with onion seeds, watered with Tap water (control sample), EVOdrop filtered water, saturated with hydrogen from EVOdrop hydrogen technology (sample).

Day of Experiment	Number of Sprouts (Control Sample) cm	Height of Sprouts (Control Sample) cm	Number of Sprouts (Sample) cm	Height of Sprouts (Sample) cm
1st day	0	0	0	0
6th day	0	0	3	2.9
9th day	2	2.6	8	5.6
12th day	4	5.3	12	8.4
15th day	5	7.7	15	10.3

In Bulgaria, under natural conditions, Evodrop water was tested on 15 beans as sample and 15 beans as control sample. The difference between the results estimated with t-test of Student was significant ($p<0.10$).The crop watered with EVOdrop filtered water+ hydrogen water had an average height of 155 cm. The result of the tap water irrigated crop was 141 cm (Fig. 7).

In this regard, in Bulgaria, and in Europe in general, water filtration with zeolite is quite widespread (15-17). Shungite filtration is also applied in Europe (18-20). The achieved results of EVOagri project in Africa show the

Fig. 6. Results (15th day) with onion seeds, watered with Tap water (control sample), EVOdrop filtered water, saturated with hydrogen from EVOdrop hydrogen technology (sample).

Fig.7 Results with beans.

importance of water quality for its absorption by vegetables and for increasing their productivity. An additional analysis was done with f(E) and NES. The function f(E) is spectrum of distribution according to energies. NES is Non-equilibrium Energy Spectrum (NES). The Non-equilibrium Energy Spectrum (NES) and f (E) is measured in eV^{-1} (20, 21). Antonov's method for discrete evaporation of water drops as a physical effect was published at Harvard University (22). It is the basis for the spectral method NES (23, 24). These parameters are related to the ability of water molecules to bind into clusters, and to penetrate through the cell membrane of the plants (25-29). Table 2 illustrates the results of the comparative analyses between EVOdrop water and other waters (13, 30).

Research has been conducted in Bulgaria regarding the filtration of rainwater using EVOdrop technology. It was established a full cleaning of nitrates, typical of acid rain. Alkalization of the water with turbine was determined (Table 3). The research was performed according to Ordinance No. 9/2001, Official State Gazette, issue 30, and

Table 2. Comparative analyses between EVOdrop water and other waters

Type of Water	Value eV $^{-1}$ of Local Extremum at (-0.1362– -
Rainwater, Sofia, Bulgaria	15.1±1.1
Deionized water	18.2±1.2
Mountain water from Vasiliovska mountain, Bulgaria	44.9±2.2
Northern Rhodope	59.3±3.0
Glasier Rosenlaui, Switzerland	70.1±3.5
Glasier Mappa, Chile	81.3±4.1
Tap water from Zurich before EVOdrop device	38.3±1.9
EVOdrop drinking water	128.3±6.5

Decree No. 178/23.07.2004 regarding the quality of water intended for drinking and domestic purposes (7-9). The research was performed in licenced laboratory Eurotest control with number of documents: 8860; 8861/29.04.2022.

The obtained results show, on the one hand, the great importance of irrigation water quality for plant growth and productivity. Good water quality is also important for saving water resources and fertilizers. Water scarcity in many areas of the world is a huge problem for nature and humanity. In those areas, water is not only scarce, but often has an increased salt content, which makes it unsuitable for drinking and watering crops. EVOagri technology offers an environmentally friendly and efficient solution for improving water quality. The use of water treated with this technology ensures an increase in agriculture yields. As a result, we recommend the wide implementation and use of this technology in water-scarce areas, as well as in those with poor water quality for drinking and agricultural needs.

Conclusion

The research results clearly show that EVOagri is environmentally friendly technology. The high efficiency of its application for purification of waters and their use in agriculture to increase crop yields, economy of irrigation water and fertilizers is proven.

Significant increasing of the production yield of the tested crops in different countries in the world using EVOagri technology is achieved. Stimulation of seeds germination after soaking with EVOagri water has also been established. Their use reduces the toxic effect of irrigation water with a high salt content on plants.

In Bulgaria, it is found that mountain spring water is much better for crop growth stimulation than tap water. It has been also established that the EVOagri technology is efficient for purifying and alkalizing water from acid rain.

Authors contributions

Conceptualization, I. I., T. P. P., Y. K-K. and R. B; methodology, F. H., I. I., N. N. and I. A.; validation, F. H. and N. V.; formal analysis, A. I. I. and F. H.; investigation, I. I., T. P. P. and R. B.; resources, M. A. and I. A.; writing— original draft preparation, I. I., F. H., P. V. and T. P. P.; writing— review and editing, R. B., N. V. Y. K-K. and N. N.; visualization, T. T., M. A., G. G. and S.K.; All authors have read and agreed to the published version of the manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare

Ethical issues : None.

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Table 3. Parameters measured in comparison with those of Ordinance No. 9/2001, Official State Gazette, issue 30, and Decree No. 178/23.07.2004 regarding the quality of water intended for drinking and domestic purposes

Controlled parameter	Measuring unit	Maximum Limit Value	Results	
			Rain water	EVOagri water
1. pH	pH values	≥ 6,5 and ≤ 9,5	7.31±0.11	7.52±0.11
2. Nitrates (NO_3^-)	$mg.L^{-1}$	50	0.56±0.17	<0.5
3. Solute concertation	ppm		45.5	<0.5

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