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Issues on Dry Matter Accumulation Through Photosynthesis, Compared, on Plum Tree, Apple Tree and Walnut Tree, Using Bio-phyto-dynamic Modulators AD

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Abstract. Improving the quality and quantity of fruit must become a priority of modern horticulture, so that any new method that contributes to this goal is welcome. Plum, apple and walnut are three species of fruit trees, namely trees, covering a significant place in romanian horticulture. The devices A.D. are recognized through numerous conducted experiments. We are the first researchers that have done this kind of expirience and 2012 was the first year when we have initiated it. This is the reason why we cannot give references to any previous papers on this subject. We have chosen to experience the effect of these on three species mentioned above. We have compared the amount of dry matter assimilated in the the witness' and the individual's leaves during one day, namely witness-witness, individual-individual and individual-witness. The method comprises the collection of biological material (leaves) in two phases: the first in the morning and the second in the afternoon. The collected material is dried and weighed in order to obtain the values which must be compared. The value's analysis has shown, with a negligible error, the influence of the three devices used on dry matter accumulation and on photosynthesis process. The use of bio-phyto-modulators improves the photosynthesis process. The selection of the optimal bio-phyto-dynamic modulators, their range and their combinations should be made only after achieving a sufficient number of experiments.

Keywords: plum, apple, walnut, bio-phyto-dynamic modulators, photosynthesis, influence, error.

INTRODUCTION

The modern world's evolution leads inevitably to a higher and more diverse food demand. The plums, apples and walnuts play a very important role in the population's every-day meals, whether consuming them directly – as such, whether consuming products that have any of these fruits as main ingredient. The producers are trying to increase and diversify the offer in order to be able to cover a wider spectrum from the population's demand (Chira, 2005).

When growing fruit-trees we need to follow a series of rules and methods which can be improved anytime and without which an increase of the quality and quantity of the production cannot be guaranteed. In this context, there have to be considered many factors, beginning with the initiation of the culture and throughout the whole period of its existence: the location where the orchard is about to be sited, the land's exposure, the soil, the climatic factors (temperature, light, humidity), the suitable species, the maintenance activities (agro-pedological, cleaning, phitosanitary protection) (Oprea and Ropan, 2010).

The growing of the fruit trees as a branch of the horticulture is a domain highly difficult to approach because there are needed knowledge from several related domains: agriculture, horticulture, pedology, plants' physiology, agro-technics, soil chemistry, plants' protection, agro-meteorology, integrated farms' management etc. managing such a culture may lead to failure, unless there are followed some basic principles, established after the researches made in this domain (Lupescu, 2007).

Firstly, setting a fruit tree culture involves clearly establishing the type of orchard (for experiments, for industry or for the family consume), delimitating the available space and establishing the culture system that is to be approached. There are several tree farming systems that can be approached: classic (conventional), fruit agriculture, intensive, super-intensive, organic, ecologic and long-term (Roman *et al.*, 2009). The nowadays trend is the orientation towards systems less harmful for the environment and human beings, systems able to preserve the resources of the natural environment and that produce enough and high-quality fruits.

The climatic factors have a major role in the tree farm development; having any of these factors out of the normal parameters leads to the decrease of the production and to the increase of the exploitation inputs. We will approach each of these factors separately in order to see how much does each one of them contribute to the development of a tree orchard.

The light and *the solar radiation* is the energy source received from then sun which is directly used in the photosynthesis process. The life of the plants from a tree farm depends on the solar energy; therefore it is a factor that has a deeply restrictive role. The need for light is different depending on the species. The contribution of the first factor, the light, is materialised in benefices on the trunk's, branches' and leaves' growth and development; in the increasing of the resistance towards diseases, pests and frost; in the development of the flower buds that are necessary for a rich and quality production (Ghidra *et al.*, 2004).

The temperature restricts the area of spreading of the fruit-trees species because it contributes to the appearance of the pheno-phases specific to each species. In the case of any species there are specific biological thresholds and intervals and the sum of the temperatures from a production season is also different.

The humidity is another factor which is essential for the plants' development. The organs of each tree, along with the fruits contain a high quantity of water (60-85% the organs and 77-92% the fruits) (Popescu *et al.*, 1993). The quantity of water contained by the plant varies depending on the intensity of the transpiration process: the higher the soil humidity the lower the value of the transpiration coefficient; when the temperature is high this coefficient rises causing a higher need for water. Ecologically, the humidity offers details on the species' resistance on drought or excessive precipitations and helps to establish the best area for growing each species.

The air, another factor essential for the life, helps in the photosynthesis process. It is actually a result of this process being eliminated by the plant through its leaves. The oxygen in the air is an element that must be found in the soil and it is necessary for the roots development. The carbon dioxide is one of the 'raw materials' used in the photosynthesis and it is also a component of the air. The nitrogen is less important because it cannot be used directly by the plants but only through the ammonium salts (Heywood and Watson, 1995).

There is a different group of climatic factors which, depending on their intensity, may produce negative effects on a tree farm. The hail destroys the trees' leaves and flowers, harms the sprigs**,** takes down the fruits that are already formed, causes injuries that help the development of fungi**,** bacteria and viruses. The excessive heat may block the physiological processes, directly if a certain critical threshold is surpassed and indirectly because of the intensification of the drought. The late white frosts and frosts during the spring or autumn cause damages to the buds, flowers, sprigs and leaves. The white frost may cause mechanical reactions and even the buds' asphyxiation. The snow, in large amounts, along with blizzard, damages the trees' branches from mechanical and thermic points of view because of the prolonging of the excessive frost period (Mihăiescu, 1998).

All of these factors influence positively and negatively a fruit-tree plantation. In a long-term culture system we have to take into account each and every one of them and we

must find solutions to diminish the losses caused by the variation of these factors' parameters that influence the plants' metabolism and, implicitly, the photosynthesis.

MATERIALS AND METHODS

The A.D. bio-phyto-modulators are known as devices that have a positive effect: the optimisation of the environment conditions. So they can be used for improving the life quality of plants and animals and also of the human beings (www.viatasienergie.ro). The optimisation of the environment conditions for the plants' growing and development plays an essential role in the increase of the production's quality and quantity. The A.D. devices influence the environment by generating the optimal vibration which, in our case, stimulates the accumulation of dry substance in the leaf, through photosynthesis. This experiment was made on three levels of height, at the following species: *Prunus domestica* (Fig. 2), *Malus domestica* (Fig. 1) and *Juglans regia* (Fig. 3).

Fig. 1. *Malus domestica*

Fig. 2. *Prunus domestica*

Fig. 3. *Juglans regia*

In this experiment we have used vegetal material (leaves) collected from six individuals (one witness for each species). The individuals belong to a rectangular orchard of approximately 2000 square meters, placed on a slope, with north-north-eastern exposure. Their age is of 20 years and their medium height is 3.5 meters. The minimum distance between two consecutive individuals from which we have taken the samples is 7 meters.

The six individuals from which we have collected the biological material were each divided into three levels. The A.D. devices were planted approximately at the middle of the second level. The exposure was between 9.00 and 16.00.

In order to determine the content of dry substance we have used an indirect method. We have used the following materials: thermoregulation oven with ventilation; aluminum vials with lid; glass desiccator lid and hygroscopic substance; analytic scale with a precision of 0.0001g. Samples were introduced individually, in separate vials aluminum. Then cap vials were put in the oven, previously heated to 105°C, and were left for 60 minutes 105°C. After this period of time vials were removed from the oven and placed in the desiccator for 45 minutes. These procedures were meant to decrease the samples' humidity to minimum, so that the weight at the moment of the weighing remains constant.

Each sample was weighed before drying and after drying. The weighing approximation of analytic scale was 0.0001g.

RESULTS AND DISCUSSIONS

The results obtained following the determinations, after the exposure to the light are presented in the tables below:

Tab. 1.

The quantity of dry substance at the three levels
comparatively witness- witness, individual- individual and individual-witness
Apple tree

No.	Level	Weight witness (g) in the morning	Weight with D.E.A. + D.I.E.E. (g) in the morning	Weight witness (g) in the evening	Weight with D.E.A.+ D.I.E.E. (g) in the evening	Difference compared to the witness		Difference between the same individuals	
						In the morning	In the evening	Indivi-dual D.E.A.+ D.I.E.E.	Witness
1.	Base	0.0844	0.0860	0.0983	0.0907	0.0016	-0.0076	0.0047	0.0139
2.	Middle	0.0894	0.0969	0.0954	0.0908	0.0075	-0.0046	-0.0061	0.0060
3.	Top	0.1210	0.1124	0.1102	0.1165	-0.0086	0.0063	0.0041	-0.0108

Tab. 2.

The quantity of dry substance at the three levels
comparatively witness- witness, individual- individual and individual-witness
Plum tree

No.	Level	Weight witness (g) in the morning	Weight with D.E.A. + D.I.E.E. (g) in the morning	Weight witness (g) in the evening	Weight with D.E.A.+ D.I.E.E. (g) in the evening	Difference compared to the witness		Difference between the same individuals	
						In the morning	In the evening	Individual D.E.A.+ D.I.E.E.	Witness
1.	Base	0.0982	0.1181	0.0881	0.1138	0.0199	0.0257	-0.0043	-0.0101
2.	Middle	0.1045	0.1081	0.0981	0.1170	0.0036	0.0189	0.0089	-0.0064
3.	Top	0.1281	0.1201	0.0938	0.1165	-0.0080	0.0227	-0.0036	-0.0343

Tab. 1, Tab. 2 and Tab. 3 show that the best results were obtained by applying bio-phyto-modulators DEA + DIEE to apple tree. At plum tree significant results were obtained at level 2 and walnut tree at level 3. Combination of DEA + DIEE influenced positive

photosynthesis by obtaining a more intense water and minerals cycle for every plant of these two cases. Because of leave collecting there is the possibility to be insignificant differences between the leaves collected in the morning and the ones collected in evening. The leaves collecting was not so homogeneous because the foliar cover of trees at the time contains leaves of different sizes and thicknesses. In the day of the experiment the light intensity may have been higher and this thing may have led to the inhibition of the photosynthesis process.

Tab. 3.

The quantity of dry substance at the three levels comparatively witness- witness, individual- individual and individual-witness Walnut tree

No.	Level	Weight witness (g) in the morning	Weight with D.E.A. + D.I.E.E. (g) in the morning	Weight witness (g) in the evening	Weight with D.E.A.+ D.I.E.E. (g) in the evening	Difference compared to the witness		Difference between the same individuals	
						In the morning	In the evening	Individual D.E.A.+ D.I.E.E.	Witness
1.	Base	0.0589	0.0976	0.0651	0.0844	0.0387	0.0193	-0.0132	0.0062
2.	Middle	0.0773	0.0890	0.0654	0.0846	0.0117	0.0192	-0.0044	-0.0119
3.	Top	0.0790	0.0929	0.0784	0.0973	0.0139	0.0189	0.0044	-0.0006

Tab. 4.

Relative error resulted after the determinations at the apple tree

No.	LEVEL	WITNESS (%)		D.E.A.+D.I.E.E. (%)	
		In the morning	In the evening	In the morning	In the evening
1.	Base	0.1184	0.1017	0.1162	0.1102
2.	Middle	0.1118	0.1048	0.1031	0.1101
3.	Top	0.0826	0.0907	0.0889	0.0858

Tab. 5.

Relative error resulted after the determinations at the plum tree

No.	LEVEL	WITNESS (%)		D.E.A.+D.I.E.E. (%)	
		In the morning	In the evening	In the morning	In the evening
1.	Base	0.1018	0.1135	0.0846	0.0878
2.	Middle	0.0956	0.1019	0.0925	0.0854
3.	Top	0.0780	0.1066	0.0832	0.0967

Tab. 6.

Relative error resulted after the determinations at the walnut tree

No.	LEVEL	WITNESS (%)		D.E.A.+D.I.E.E. (%)	
		In the morning	In the evening	In the morning	In the evening
1.	Base	0.1706	0.1536	0.1024	0.1184
2.	Middle	0.1293	0.1529	0.1123	0.1182
3.	Top	0.1265	0.1275	0.1076	0.1027

The results from Tab. 4, Tab. 5 and Tab. 6 show clearly that there can't be significant errors, because they are very small.

Comparing the results from this year with those obtained in 2012 we can see that they are very similar. Apple tree is the individual who reacted best to bio-phyto-modulators DEA + DIEE apply, followed by plum tree and walnut tree (Colceriu, 2012). Apple tree has reacted better than others possible because it is a grafted species. It is important to mention that the meteorological conditions during the days when we have made the experiments have been very similar.

The use of A.D. devices in agriculture and horticulture showed that it has a benefic influence to some specific processes. We suppose that we will be able to explain in the near future how and how much these devices influence physiological processes from plants.

CONCLUSION

The experiment we propose in this article has started in 2012 and continued in 2013. We are the first researchers who approach this type of experiment. For this reason we haven't had the opportunity to consult the bibliography for the topic. What we could see is a small amount of information regarding the device AD on the site www.viatasienergie.ro.

In order to evaluate clearly the effect of A.D. bio-phyto-modulators on photosynthesis at fruit trees, we need a large number of experiments made over several years and in different climate conditions. From these two research reports until now we can conclude that the application of these modulators influences photosynthesis in some way. We can't quantify this influence yet.

The use of bio-phyto-modulators improves the photosynthesis process. Choosing the optimal bio-phyto-modulators, their range and their combinations should be made only after achieving a sufficient number of experiments.

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