

Report

Testing of organic and conventionally grown seeds with Gas Discharge Visualization technique.

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Subjects of the study:

Subjects of the study were organic and conventionally grown following seeds: Black Oil Sunflower
Mung Beans
Hard Red Winter Wheat
Broccoli
Red Clover
Fenureek

In every test 50 seeds were tested.

Methods

Gas Discharge Visualization (GDV) device GDV Pro was used in the tests. Seeds were distributed on the surface of the optical electrode and a special nontransparent cover with holes for every seed was positioned on top providing air space around every seed. Grounding plate was positioned on top (fig.1).

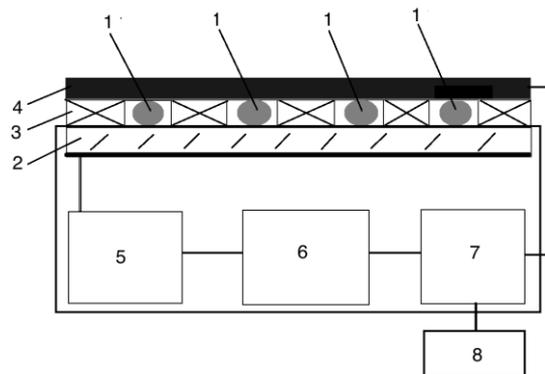


Fig.1. Experimental schematics. 1 – seeds; 2 – glass electrode with transparent conductive cover at the back; 3 – dielectric cover with holes; 4 – electrode; 5 – power source; 6 – optical system; 7 – electronic board; 8 – computer.

Selection of the voltage parameters and dielectric covers 3 was individual for every group of seeds. Parameters are presented in Table 1.

Table 1

Parameters of the experimental set

№	Seeds	Voltage applied, V		Parameters of the dielectric cover, mm	
		Dry seeds	Wet seeds, sprouts	Diameter of hole, mm	Height of dielectric cover, mm
1	Black Oil Sunflower	-	160	18	3.0
2	Mung Beans	170	170	16	3.5
3	Hard Red Winter Wheat	155	155	14	1.5
4	Broccoli	-	130	5	0.2
5	Red Clover	-	140	5	0.2
6	Fenureek	-	135	14	1.5

After applying impulse voltage to the electrode, a faint glow appears around every seed due to the emission of electrons and photons and stimulating low-current gaseous discharge. Glow is photographed by a CCD camera, creating an image in the computer. Special software allows calculating a set of parameters for every image, the main are:

- Area of an image, measured in pixels;
- Intensity of light;
- Fractality of an image.

Data was averaged on 5 measurements.

2) Seeds germination

Seeds germination was done at the room temperature in sterile Petri dishes 90 mm in diameter and 15 mm height. Seeds were positioned by 50 (for sunflower by 25) on the wet filter paper placed on the bottom of the dish (fig.2).



Fig.2. Seeds germination.

Evaluation of sprouting was done 36 hours after beginning (for sunflower 60 hours after beginning).

Analysis was done in the following stages (Table 2).

Table 2

Stages of the experiment

Seeds	Dry seeds	Wet seeds 12 hours	Sprouts 36 (60) hours
Black Oil Sunflower	no	done	Done 60 h after wetting
Mung Beans	done	done	done
Hard Red Winter Wheat	done	done	done

Broccoli	no	done	No, as after sprouting seed cover is totally destroyed and cotyledons get out.
Red Clover	no	done	No, as after sprouting seed cover is partially destroyed.
Fenureek	no	done	done

Just before capturing at 36 and 60 hours root and sprout was removed to avoid artifacts.

3) Statistical processing was done in Excel program.

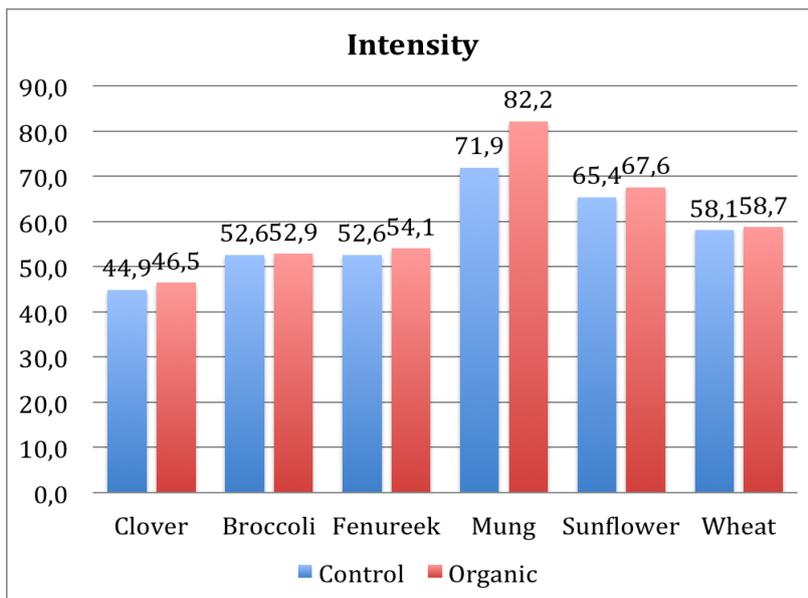
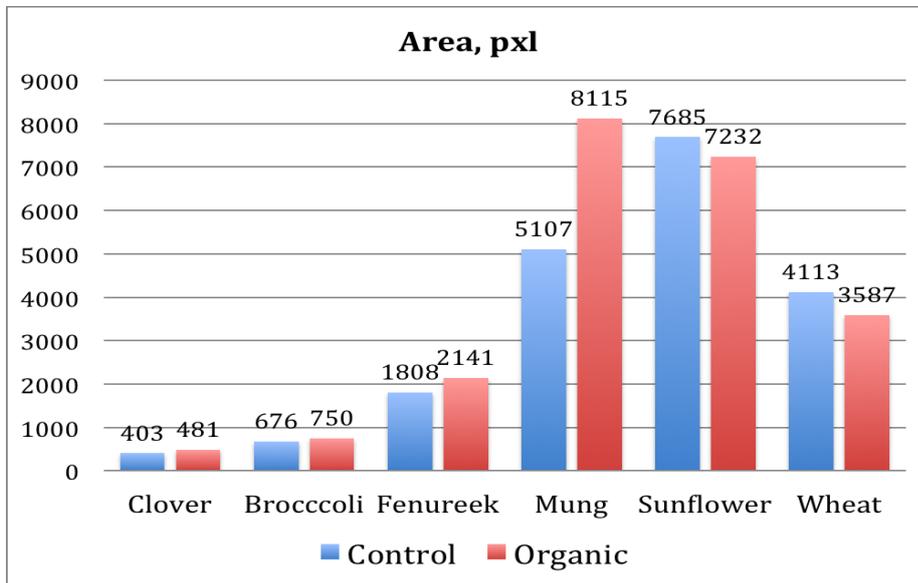
Results

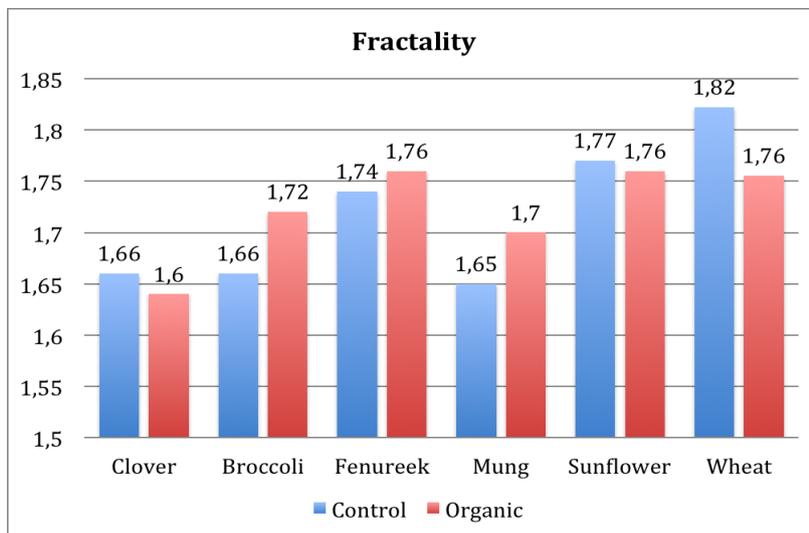
For all seeds statistically significant difference between organic and conventionally grown seeds was found for Area parameter (except broccoli) and Fractality parameter, for other parameters difference was not significant, but the tendency was clear (see Table 3 and fig. 3). Table 3 demonstrates Student coefficients of data comparison, measured at 12 hours after wetting.

Table 3.

Statistical analysis of data, measured at 12 hours after wetting.

	Clover	Broccoli	Fenureek	Mung	Sunflower	Wheat
Area	0.050	0.156	< 0.0001	< 0.0001	0,031	0,001
Intensity	0.151	0.893	0.132	< 0.0001	0,019	0.522
Fractality	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001





As we see, for different seeds the tendency is different: for Sunflower, Wheat and Clover parameters for control seeds were higher than for organic seeds, while for Broccoli, Mung Beans and Fenureek parameters for control seeds were lower than for organic seeds.

Measurements at 36 hours demonstrated the same tendency as for 12 hours.

Table 4 demonstrates the averaged percentage of sprouted seeds. As we see from the data of Table 4, there was no correlation between difference in sprouting and difference in GDV parameters of the organic and control seeds.

Table 4.

The averaged percentage of sprouted seeds

	Clover	Broccoli	Fenureek	Mung	Sunflower	Wheat
Organic	64%	74%	72%	100%	72%	94%
Control	60%	64%	100%	60%	52%	98%

Conclusion

By using GDV method statistical significant difference between organic and conventionally grown seeds on different parameters was found for the following seeds:

Black Oil Sunflower

Mung Beans

Hard Red Winter Wheat

Broccoli

Red Clover

Fenureek

These results allows to conclude that seeds, grown in different conditions, have different level of life activity.