Gelatine based gels used as biostimulators for tomato crop

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Introduction

High productivity and maintaining soil fertility are of particular importance for agriculture in the context of global population growth and increasing food requirements. The excessive use of chemical fertilizers to compensate for nitrogen deficiency in the soil has created numerous environmental problems in various ecosystems [1]. An alternative to chemical fertilizers is represented by biostimulators obtained from protein hydrolysates extracted from by-products of animal or plant origin. Biostimulators are products capable of acting on the metabolic and enzymatic processes of plants, increasing the production yield and the quality of crops. It also helps plants to deal with abiotic stress, especially in the early stage of plant development [2].

In this paper two gels based on bovine gelatin with addition of microelements and keratin hydrolysate were tested on tomato crops and the effects on seedling, and fruits were measured. The gels determined differences between treated and untreated plants regarding biometric parameters and content in vitamin C, lycopene, carotene, total polyphenols, total soluble carbohydrates and total acidity.

Figure 3: Tomato plants treated with gelatin based gels

Materials and methods

Wool and bovine hide were purchased from a local slaughterhouse and a sheep farmer from Constanta County, Romania. The gelatin was obtained by acid hydrolysis from bovine delimed hide at high temperature. The keratine hydrolysate was obtained from sheep wool by alkaline hydrolysis.

Gels were analyzed according to the standards in force or in house methods regarding the content in dry substance, total ash, total nitrogen and protein content, pH, bloom test and viscosity. The gel containing bovine gelatin and microelements was labeled GB3M, the gel containing bovine gelatin, keratin and microelements was labeled GB3MK.The seedlings were measured regarding biometric parameters (plant length, diameter, number of leaves, root development) and content in total chlorophyll and soluble carbohydrates. Tomato fruits were analyzed regarding the content of vitamin C, lycopene, carotene, total polyphenols, total soluble carbohydrates and total acidity. Methods used for the measurement of these parameters were according to the standards in force or in house methods.

Table 2: Content in total chlorophyll, soluble glucids and dry weigth for tomato seedlings

No.	Sample	Total chlorophyll content (mg/g)	Total soluble glucids (mg/100g)	Dry weigth (g%)
1	Control	1.39±0.08	81.22±10.84	15.95±1.08
2	GB3M	1.88±0.05	127.04±30.65	21.49±1.19
3	GB3MK	2.25±0.30	237.76±18.35	18.21±1.15

Results & Discussion

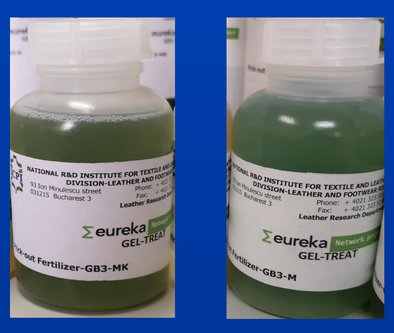

Figure 1: Gels obtained from leather industry by-products

Table 1: Physico-chemical characteristics of the gelatine based gels

No.	Characteristics	GB3M	GB3MK
1	Dry substance, %,	7,07	8,49
2	Total ash, %	0.42	0.60
3	Total nitrogen, %	0.96	0.95
4	Protein substance, %	5,40	5,34
5	pH, pH units	8,80	8,90
6	Aminic nitrogen, %	0,17	0,17
7	Viscosity, mPa*s	1.75	1,5
8	Bloom test, g	110	54

Figure 4: Tomato fruits obtained after treatment with gelatin based gels

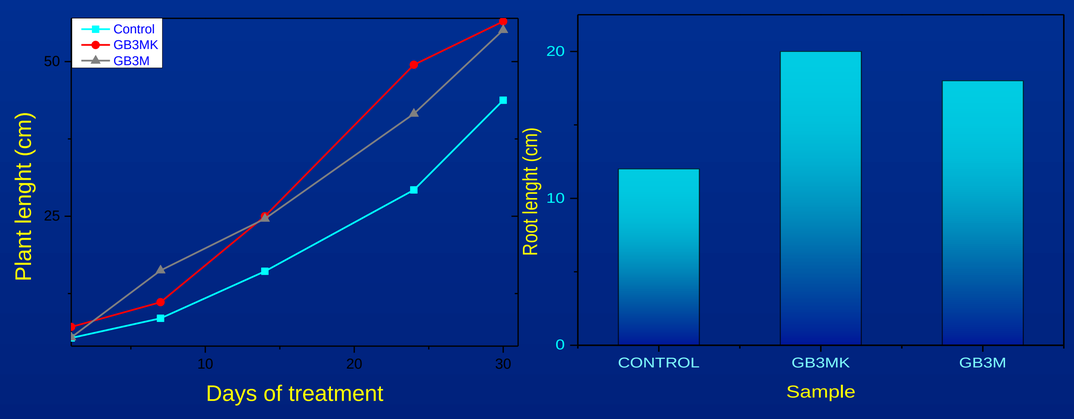

Figure 2: Plants and root length evolution of tomato plants treated with gelatin based gels

Table 3: Results obtained for ripe tomato fruits

	Sample	Dry substance (g%)	Total acidity (g ac. malic%)	Vitamin C (mg/100g)	Lycopene Content (mg/100g)	CAROTENOID Content (mg/100g)	Total soluble glucids (mg/100 g)	Total polyphenols content (mg/100 g)
Control	1	6,01	0,99	10,25	8,12	1,52	1,91	55,96
GB3M	2	6,39	0,98	9,45	8,29	1,41	2,13	56,98
GB3KM	3	7,04	0,75	18,12	12,41	1,92	2,14	62,25

Conclusions

Two gels based on bovine gelatin, microelements and keratin were obtained and tested on tomato seedlings. The gels were characterized physical-chemical. The measurements made on tomato plants in different stages of vegetation showed that plants treated with gels had a better development compared to control plants treated with water.

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