Potential Bioregulators for Rape (*Brassica napus* L.) Plants

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ABSTRACT

It is known that polyphenols are a single group of phytochemicals which present in all plants. Their biological activity is based upon functional groups capable to participate in the plant metabolism influencing cell division and biosynthesis processes. In our experiments we have evaluated the effect of spruce bark polyphenolic extract and deuterium depleted water (DDW) as rapeseed plant bioregulators. After aqueous extraction of bark and quantification and identification of polyphenolic compounds by HPLC methods, we applied the extracts in the growth medium of rapeseed plants. Assessment the influence of extracts on rapeseed plants was achieved through determination of germination energy and capacity, biomass accumulation, assimilatory pigments accumulation and photosynthesis activity. The results has shown that it possible to establish the highest stimulating effect of polyphenols on germination energy and capacity. These, were registered in the presence of spruce bark polyphenolic extract (SBPE) with an equivalent content of 130 mg GAE/L. Rape plants treated with DDW+SBPE have accumulated the highest amount of biomass compared with other experimental variants. The photosynthesis activity was considerably intensified especially in the presence of SBPE.

Keywords: *spruce bark, polyphenols, deuterium depleted water (DDW), rape, bio regulators*

INTRODUCTION

Rapeseed (*Brassica napus* L.) is one the largest oilseed crops. Growth and development of plants depend on environmental conditions. Recent researches has shown that SBPE and DDW have a great influence on development of plants, namely in developing cells and tissues and changes that occur in normal water features leading to significant changes in fundamental processes of biosynthesis (Tanase *et al.*, 2012; Tanase *et al.*, 2013).

AIMS AND OBJECTIVES

The aim of this study was to evaluate the effect of DDW and SBPE as rapeseed plant bio regulators. At the same time a combination of DDW with SBPE could be interesting to obtain information about their role in plant development.

MATERIALS AND METHODS

Spruce bark is a major waste product from forestry and wood processing industries. On the other hand DDW is a residue resulted in the heavy water obtaining. The extracts were characterized from the point of view of total content of polyphenols (mgGAE/L), tannins, flavonoids, flavonols, and antocyanins (Tanase *et al.*, 2013).

The field experiment was performed in the field of Botanical Garden "Anastasiu Fatu" of Iasi, over a period of 120 days from April to August, for two consecutive years (2010 and 2011), and was carried out in triplicates. The average value was reported. Tested solutions were the following: control – tap water, DDW, DDW in combination 1:1 with SPBE with an equivalent content of 191 mg GAE/L (DDW + SBPE), SBPE with 130 mg GAE/L (SBPE1) and SPBE with 191 mg GAE/L (SBPE2).

Tab. 1. Physiological indices for rapeseed grown under SBPE and DDW treatment

	Tested solutions	Germination process (% comparing with control)		Leaves number (% comparing with control)	Biomass accumulation (% comparing with control)	
		Energy	Capacity		Stem + root	Leaves
1	DDW	33.23 ±0.21	24.34 ±0.76	15.74 ±0.21	7.23 ±0.15	13.23 ±0.07
2	DDW+SBPE	51.22 ±0.54	38.44 ±0.65	23.14 ±0.48	35.11 ±0.25	40.87 ±0.73
3	SBPE1	55.54 ±0.81	30.67 ±0.45	31.48 ±0.59	41.56 ±0.43	55.63 ±0.87
4	SBPE2	27.12 ±0.15	15.19 ±0.26	7.7 ±0.02	3.22 ±0.04	15.56 ±0.41

Tab. 2. Photosynthetic pigments contents and assimilation rate for rapeseed grown under SBPE and DDW treatment

	Tested solutions	Chl a (µg/g)	Chl b (µg/g)	Carotene (µg/g)	Chl a+b (µg/g)	chl a/b	Assimilation rate (A, µmol CO ₂ m ⁻² s ⁻¹),
1	Control	204.09 ±2.87	39.62 ±0.56	38.02 ±0.54	243.71	5.15	14.65 ±0.07
2	DDW	282.12 ±2.54	54.89 ±0.89	54.89 ±1.02	348.15	4.27	24.28 ±0.12
3	DDW+SBPE	285.89 ±2.98	58.87 ±0.76	58.87 ±1.11	344.07	4.91	28.91 ±0.11
4	SBPE1	272.85 ±3.01	47.81 ±0.54	47.81 ±0.97	336.41	4.29	32.41 ±0.15
5	SBPE2	252.29 ±2.13	45.95 ±0.43	45.95 ±0.65	309.24	4.43	17.34 ±0.08

The amount of used solution was 10 mL/plant/application.

To determine the biomass accumulation, ten plants for each experimental variant were harvested and separated into root, stems and leaves, at 120 days after seedling and then dried at 65°C. The results obtained are the average from the ten samples. The assimilation rate (A, µmol CO₂ m⁻² s⁻¹), was determined with a LCi portable photosynthesis system. The concentrations of chlorophyll and carotenoids pigments were calculated using the specific coefficients suggested by Lichtenthaler and Wellburn (1983).

RESULTS AND DISCUSSION

The obtained results revealed that the used compounds have a stimulating germination energy and capacity for all experimental variants. The combination DDW + SBPE determines the highest degree of stimulation for the followed indices. Also, in case of SBPE1 (130 mg GAE / L) and DDW + SBPE (91 mg GAE / L) variants is recorded an increase of biomass yield, compared to control (Table 1). Photoassimilating pigments content, is higher in all experimental variants, compared to control. The highest rate of assimilation was recorded in the variant SBPE1 and DDW + SBPE (Table 2).

CONCLUSION

It was found that spruce bark polyphenolic extract (130 mg GAE / L) and DDW have a stimulating effect on all physiological indices recorded (germination energy and capacity, biomass accumulation, photosynthetic pigments contents and assimilation rate). DDW+SBPE combination, revealed a possible synergistic action. Based on presented results in the present work, we proposed to use SBPE and DDW as bio regulator in the cultivation of rape plants and to its effects on the seeds production.

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