

PLANT GROWTH RETARDANTS FOR THE TREATMENT OF VEGETABLES USED AS RAW MATERIALS FOR THE FOOD INDUSTRY

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Abstract

Besides the growth retardant effect, which, in most cases is the main purpose, the plant growth retardants can be successfully used for the treatment of vegetable crops supplying the food industry with raw materials in order to increase the yields and to improve the quality of the products. The results of the tests regarding the phyto-regulating action, made on some vegetable cultivars (tomatoes, red peppers, cucumbers, onion), proved that the product Romtrel, obtained according to a procedure of our own, has similar effects, in expression and intensity, with those of Ethrel (produced by Amchem).

Keywords: *plant growth retardants, 2-chloroethylphosphonic acid, tomatoes, red peppers, cucumbers, onion*

Introduction

The plant growth retardants are synthetic substances, which inhibit, for a period of time, the elongation of stem and shoots, without irreversible blocking the vital metabolic and developmental processes in plants. Besides the growth retardant effect, which, in most cases is the main purpose, some other physiological effects, with beneficial implications may occur. In some cases, the retardant effect may even become of secondary importance. By influencing some metabolic processes, the treatments with retardants can induce the more intense accumulation of compounds that give taste, color, flavor, thus improving the quality and the commercial value of the products. Such treatments can also influence the fruit acidity, the content in sugars, proteins, vitamins, minerals etc. The treatments with retardants can accelerate and uniform the fruits ripening, can promote the defoliation and promote the abscission of fruits, so allowing the mechanical harvesting to be made more efficiently, reducing the losses on varieties which have a tendency to shatter and improving the quality of the

obtained products. The retardants don't create problems due to the pollution or the remanence in the food products, being used in very small quantities (ppm) and being metabolized by plants (Neamțu, 1991).

The 2-chloroethylphosphonic acid (CEPA) is one of the most valuable retardants, because of its wide action area and efficiency as plant growth regulator. CEPA can modulate plant growth and metabolism by releasing ethylene (a phytohormone) from root, bloom, fruit and other tissues. It can be used to prevent lodging in cereals, maize and flax, to promote pre-harvest ripening of top fruit, soft fruit, tomatoes, sugar beet, fodder beet, coffee and many other products, to facilitate the harvest of fruit and berry crops (by loosening the fruit) and to accelerate post-harvest ripening (Saupe, 2004).

CEPA is a plant growth regulator with systemic properties. It penetrates into tissues and is translocated. It decomposes at cytoplasmic pH with the formation of ethylene (the active metabolite), phosphate and chloride ion (Tseng, 2000). CEPA is considered relatively non-toxic to animals and humans, it's potential for contamination of soil or groundwater is low and it don't creates problems due to the remanence in food products (Puga, 2002).

Experimental

Romtrell is a conditioned form of CEPA obtained according to a procedure of our own (Căpriță, 1995) and has the composition: CEPA 40%, 1,2-propanediol 20%, water 40%. The conditioning is necessary to make the product easy to use and to respond to some special demands related to its behavior on treated plants (e.g., a good adherence on leaves and fruits, a good absorption of the active substances in plant).

Romtrell was tested 3 years on some vegetable cultivars regarding the phyto-regulating effects. Its action was compared with that of Ethrel (produced by Amchem) having the same active substance, on tomatoes, red peppers, cucumbers and onions.

Treatments on early tomatoes in greenhouse (Export II hybrid) were applied to fruits having 2.5-3 cm diameter, spraying solutions with 250 and 500 ppm active substance. Treatments were intended to accelerate the fruits ripening.

Treatments on early tomatoes in field (Vidra-14 hybrid) were applied to fruits having 2.5-3 cm diameter, spraying solutions with 250 and 500 ppm active substance. Treatments were intended to accelerate the fruits ripening.

Treatments on tomatoes for processing (Heinz-1370 variety) were applied to fruits when 80% of fruits were almost ripe, spraying solutions with 2500 and 5000 ppm active substance. Treatments were intended to accelerate and to make uniform the fruits ripening.

Treatments on red peppers (Rubin variety) were applied to fruits at the ripe beginning stage, spraying solutions with 2500 and 5000 ppm active substance. Treatments were intended to accelerate and to make uniform the fruits ripening.

Treatments on cucumbers in field (Cornichon de Paris variety) were applied to plants having 5-6 real leaves, spraying solutions with 250 500 and 750 ppm active substance. Treatments were intended to increase the production, as a consequence of increasing the number of female (fruit bearing) flowers.

Treatments on onion (Stuttgarten Riesen variety) were applied to seeds before sowing, by moistening 12 hours in solutions with 50 and 100 ppm active substance. Treatments were intended to accelerate the germination, to induce the sprout and to increase the yields.

Results and Discussions

The results of the treatments on early tomatoes in greenhouse, as arithmetical mean of the three years of testing, are presented in table 1. Ethrel 250 ppm accelerated fruits ripening, increasing the early production with 12.9% compared to untreated control. Romtrel 250 ppm gave better results, increasing the early production with 31.7% compared to untreated control. In addition, Romtrel 250 ppm increased the total production with 7.5% and the mean of the fruits weight with 4.2% compared to untreated control. Ethrel 500 ppm and Romtrel 500 ppm gave less edifying results.

Table 1. Romtrel and Ethrel treatments on early tomatoes in greenhouse

Treatment	Early production (%) (before August 1)	Total production (%)	Mean of the fruits weight (%)
Control	100	100	100
Ethrel 250 ppm	112.9***	-	-
Ethrel 500 ppm	103.2	-	-
Romtrel 250 ppm	131.7***	107.5**	104.2
Romtrel 500 ppm	105	-	-

DL 5% = 4.64%; DL 1% = 6.19%; DL 0.1% = 8.08%; *** = signification

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The results of the treatments on early tomatoes in field, as arithmetical mean of the three years of testing, are presented in table 2. Ethrel 250 ppm and Romtrel 250 ppm accelerated fruits ripening, increasing the early production with 16-18%, the total production with 6% and the mean of the fruits weight with 5% compared to untreated control. Ethrel 500 ppm and Romtrel 500 ppm were less efficient regarding the yields increasing, but increased the mean of the fruits weight with 6% compared to untreated control.

Table 2. Romtrel and Ethrel treatments on early tomatoes in field

Treatment	Early production (%) (before August 1)	Total production (%)	Mean of the fruits weight (%)
Control	100	100	100
Ethrel 250 ppm	117.3***	106.5***	105*
Ethrel 500 ppm	107.9***	102*	106.5**
Romtrel 250 ppm	116.3***	106.3***	105*
Romtrel 500 ppm	103	104.2***	106**
DL 5%	4.14%	1.99%	3.75%
DL 1%	5.52%	2.67%	5.01%
DL 0.1%	7.20%	3.48%	6.54%

*** = signification

The results of the treatments on tomatoes for processing, as arithmetical mean of the three years of testing, are presented in table 3. Treatments with Ethrel and Romtrel 5000 ppm increased the early production with about 70%, and those with 2500 ppm increased the early production with about 47% compared to untreated control. The total production was little influenced, all the fruits being ripe. The fruits quality was good; a good turgor was observed, especially when 2500 ppm active substance was used.

Table 3. Romtrel and Ethrel treatments on tomatoes for processing

Treatment	Early production (%)	Total production (%)
Control	100	100
Ethrel 2500 ppm	147.6***	101.1
Ethrel 5000 ppm	170***	100.8
Romtrel 2500 ppm	146.7***	100.4
Romtrel 5000 ppm	171.9***	101.5

DL 5% = 17.1%; DL 1% = 22.82%; DL 0.1% = 29.79%; *** = signification

The results of the treatments on red peppers, as arithmetical mean of the three years of testing, are presented in table 4. Ethrel 5000 ppm

and Romtrel 5000 ppm were the most efficient in accelerating fruits ripening, increasing the early production with about 45% and 40% respectively, compared to untreated control; the total production increased with 9.4% and 7.2% respectively and the amount of ripe fruits with 32% and 35% respectively, compared to untreated control. Ethrel 2500 ppm and Romtrel 2500 ppm were less efficient.

Table 4. Romtrel and Ethrel treatments on red peppers

Treatment	Early production (%)	Total production (%)	Ripe fruits (%)
Control	100	100	100
Ethrel 2500 ppm	114.4*	103.2*	110.8*
Ethrel 5000 ppm	144.6***	109.4***	132***
Romtrel 2500 ppm	114.8*	102.4*	112*
Romtrel 5000 ppm	139.1***	107.2***	135***
DL 5%	11.49%	2.39%	10.49%
DL 1%	15.42%	3.21%	14.04%
DL 0.1%	20.33%	4.24%	18.56%

*** = signification

The results of the treatments on cucumbers, as arithmetical mean of the three years of testing, are presented in table 5. Ethrel 250 ppm and Romtrel 250 ppm were the most efficient, increasing the total production with about 16%, compared to untreated control. The results of the treatments on onion, as arithmetical mean of the three years of testing, are presented in table 6.

Table 5. Romtrel and Ethrel treatments on cucumbers

Treatment	Production (%)	Signification
Control	100	
Ethrel 250 ppm	116.4	**
Ethrel 500 ppm	114	**
Ethrel 750 ppm	111	*
Romtrel 250 ppm	115.9	**
Romtrel 500 ppm	113	*
Romtrel 750 ppm	110.5	*

DL 5% = 10.16%; DL 1% = 13.51%; DL 0.1% = 17.58%

Ethrel and Romtrel 50 ppm accelerated the germination and induced the sprout, but the production was not increased, compared to the untreated control. Ethrel and Romtrel 100 ppm accelerated the germination, induced the sprout and increased the production with about 60% and 34% respectively, compared to the untreated control.

Table 6. Romtrel and Ethrel treatments on onion

Treatment	Sowing-sprout period (days)	Production (%)
Control	13	100
Ethrel 50 ppm	9	101.4
Ethrel 100 ppm	7	160.2***
Romtrel 50 ppm	9	100
Romtrel 100 ppm	11	133.8**
	DL 5%	19.82%
	DL 1%	26.36%
	DL 0.1%	34.29%

Conclusions

The results of the tests made on some vegetable cultivars, regarding the phyto-regulating action, proved that the product Romtrel, obtained according to a procedure of our own, has similar effects, in expression and intensity, with those of the product Ethrel (produced by Amchem).

Treatments with 250 ppm active substance on early tomatoes in greenhouse and in field significantly increased the early and the total production. Treatments with greater doses (particularly 5000 ppm active substance), applied on tomatoes for processing and on red peppers, accelerated and made uniform the fruits ripening, without affecting the fruits quality. Treatments on cucumbers (particularly with 250 ppm active substance) significantly increased the production, as a consequence of increasing the number of female (fruit bearing) flowers. Treatments on onion (particularly with 100 ppm active substance) accelerated the germination, induced the sprout and increased the production.

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