

RESEARCH NOTE

Sodium hypochlorite in the priming of tobacco seeds¹

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ABSTRACT – Due to the non-uniform maturation of tobacco fruits and seeds, the priming technique has been used by the tobacco industry as a way of increasing the uniformity and germinations speed of seeds. Several factors can affect priming, including the time and environment in which the treatment is performed. In order to evaluate the effect of sodium hypochlorite as priming agent at different concentrations and the priming period on the physiological quality of the tobacco seeds, it was used a seed lot of commercial cultivar CSC 439 from the Virginia varietal group, widely used by the producing companies. The seeds were subjected to priming in aerated solution at different priming periods (180, 60, 30, 15, and 5 min) and concentrations of sodium hypochlorite (1%, 0.50%, 0.25%, and 0.10 %). The physiological quality was evaluated by the water contents, germination tests, first count, germination index, initial and final stands, emergence index and electrical conductivity. The priming with sodium hypochlorite did not affect germination, but allowed a higher percentage and speed of emergence when using the 1% concentration for 180, 30 and 15 min.

Index terms: *Nicotiana tabacum*, vigor, NaClO, osmopriming.

Hipoclorito de sódio no condicionamento fisiológico de sementes de tabaco

RESUMO – Devido a maturação desuniforme de frutos e sementes de tabaco, a técnica de condicionamento fisiológico tem sido utilizada pela indústria tabacaleira, como forma de aumentar a uniformidade e velocidade de germinação das sementes. Vários fatores podem afetar o condicionamento, como o tempo e o meio em que o tratamento é realizado. Para avaliar o efeito do hipoclorito de sódio como agente condicionante em diferentes concentrações e o período de condicionamento sobre a qualidade fisiológica das sementes de tabaco foi utilizado um lote de sementes da cultivar comercial CSC 439 do grupo varietal Virgínia, largamente utilizado pelas empresas produtoras. As sementes foram submetidas ao condicionamento fisiológico em solução aerada em diferentes períodos de condicionamento (180, 60, 30, 15 e 5 minutos) e concentrações de hipoclorito de sódio (1%; 0,50%, 0,25% e 0,10%). A qualidade fisiológica das sementes foi avaliada pelos testes de germinação, primeira contagem de germinação, índice de velocidade de germinação, estande inicial, estande final, índice de velocidade de emergência e condutividade elétrica. O condicionamento com hipoclorito de sódio não afeta a germinação, mas possibilita maior velocidade e percentual de emergência quando se utiliza a concentração de 1% por 180, 30 e 15 minutos.

Termos para indexação: *Nicotiana tabacum*, vigor, NaClO, osmocondicionamento.

Introduction

Tobacco is the most important non-edible crop and the plant contributes to raise the economy in more than 150 countries.

Brazil is the largest exporter and the second largest producer of seeds and processed tobacco worldwide (Sinditabaco, 2017). *Nicotiana tabacum* is used mainly in the tobacco industry, but it is also related to the research development in several areas

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as the pharmaceutical, physiological and also in transgenesis as a model plant (Caldeira et al., 2016).

The planting requires bedding plants production under float systems because of the reduced seed size. The success depends on the production of vigorous seeds with rapid and uniform growth. However, fruit and seed maturation has been an obstacle for the tobacco industry in order to obtain high quality seeds. The use of priming allows uniformity and high germination rate as an alternative to solve this problem.

Several substances are used with the priming purpose, such as polyethylene glycol (Dresch et al., 2017), potassium nitrate and water (Caldeira et al., 2014). Some seed companies have used sodium hypochlorite for the purpose of disinfestation of seeds, being also a method recommended by the Rules for Seed Testing regarding some seeds of fleshy fruits (Brasil, 2009) and still as priming agent. This procedure sometimes leads to higher quality of lots, however, the effect of this product as a priming agent is not yet reported in the literature.

The aim of the current study was to evaluate the effect of sodium hypochlorite at different concentrations as priming agent and under several periods on the physiological quality of tobacco seeds.

Material and Methods

The experiment was performed with tobacco seeds from the Virginia varietal group, used by seed companies in Brazil of the CSC 439 commercial cultivar. The seeds were subjected to priming in aerated solution at different priming periods (180, 60, 30, 15, and 5 min) and concentrations of sodium hypochlorite (1, 0.50, 0.25, and 0.10%). The seeds were washed in running water and dried at 30 °C in a convection oven until reach the initial water content of 7.00%, and then the physiological evaluations were performed.

In the germination test, four replications of 100 seeds were used, which were sown on a blotting paper substrate, moistened with distilled water in an amount equivalent to 2.5 times the weight of the dry substrate, in an acrylic gerbox with lid (11x11x3.5). The seeds were kept in a BOD (biochemical oxygen demand) with alternating temperature between 20 and 30 °C, 8 h photoperiod and light intensity equal to 2,000 lux (Brasil, 2009). The number of germinated seeds was evaluated daily to obtain the germination speed index (Maguire, 1962). The germination results were expressed as percentage of normal seedlings with evaluation at seven days after test assembly to obtain the first germination count, and at 16 days for germination (Brasil, 2009).

The emergence test was conducted in a float system, with sowing performed on Carolina® commercial substrate

(composed of turf, roasted rice straw and perlite, with water retention capacity equal to 51% by volume, total porosity of 76% and pH of 5,65), previously moistened (approximately 1 L of water per kg of substrate), placed in acrylic plates with individualized cells perforated with 100 cells. After sowing, the acrylic plates were kept floating on a water depth of approximately 2 cm and kept in BOD chamber with a temperature of 30 °C ± 2. The evaluation of the number of seedlings emerged with the first pair of leaves was performed daily to obtain the emergence index (Maguire, 1962). The results were expressed as percentage with evaluation on the seventh day, in order to obtain the initial stand, and on the sixteenth day for the final stand.

In the electrical conductivity test, four replications of 0.01 g of seed from each package, they were placed in a container with 5.0 mL of deionized water and maintained in BOD at 25 °C were evaluated. The conductivity reading was performed after 12 h of imbibition using the MS TECNOPON® electrical conductivity meter. Results were expressed as $\mu\text{S}\cdot\text{cm}^{-1}\cdot\text{g}^{-1}$.

The experimental design was completely randomized with four replications, under factorial (4x5)+1 with four concentrations of sodium hypochlorite (1%, 0.50%, 0,25%, 0,10%), five priming periods (180, 60, 30, 15, 5 min) and a control (unprimed seeds). The comparison of the additional control with the treatments resulting from the factorial was performed by the Dunnett's test at 5% probability (Reis et al., 2012).

Results and Discussion

According to the data presented in Table 1, no significant statistical differences were observed in the percentages of first germination count, germination and germination speed index for primed seeds at different concentrations of sodium hypochlorite and different priming times when compared with the control. Reis et al. (2012) and Nascimento and Lima (2008) state that the germination test is performed under optimum conditions, so that the seeds with similar germination and different levels of vigor do not differ among themselves in this type of evaluation.

When the primed seeds were compared with the control, the priming increased the percentage of the initial stand, final stand and the emergence rate index for some tested treatments (Table 2), highlighting especially the seeds primed at 1% sodium hypochlorite for 180, 30 and 15 min, which presented the best percentages in the three cited tests. This result corroborates those obtained by Caldeira et al. (2014), which verified that the priming has a positive effect on the emergence of tobacco seeds. In the priming performed with the concentration of 1% sodium hypochlorite and time of 60 min, the seeds had negative

Table 1. Comparison between the additional control and each treatment resulting from the factorial on the tests of first germination (FC), germination (G) and germination index (GI) of tobacco seeds subjected to priming with sodium hypochlorite.

NaClO concentration (%)	Priming time (min)	FC (%)	G (%)	GI
1.00	180	92	94	7.70
	60	83	89	7.50
	30	90	92	7.76
	15	91	92	7.61
	05	81	84	6.98
0.50	180	93	94	7.08
	60	87	92	7.48
	30	89	91	7.74
	15	84	88	7.39
	05	88	95	7.77
0.25	180	81	86	7.07
	60	86	91	7.32
	30	89	95	7.71
	15	93	95	7.70
	05	90	95	7.79
0.10	180	89	92	7.37
	60	81	91	7.26
	30	92	94	7.58
	15	85	93	7.40
	05	82	88	7.29
Control		83	91	7.20
DMS		26.18	12.09	1.41

The values followed by * differ from the control by the Dunnett's test at 5% probability.

effects of the treatment in the emergence probably due to an induction of dormancy.

In the electrical conductivity test, a significant difference was observed only for two treatments in relation to the control (Table 2). However, at the concentration of 0.50% sodium hypochlorite in the time of 60 min and at the concentration of 0.25% also for 60 min, the priming effect was negative in relation to the control (1601.70 $\mu\text{S}\cdot\text{cm}^{-1}\cdot\text{g}^{-1}$). These treatments may have damaged the cell membrane, causing higher leaching of electrolytes. More deteriorated and less vigorous seeds, when subjected to imbibition, leach higher amounts of solutes (sugars, amino acids, fatty acids, proteins, enzymes and ions) to the external medium due to the lower repair speed of the cell membrane (Carvalho and Novembre, 2011).

Table 2. Comparison between the additional control and each treatment resulting from the factorial for initial stand (IS), final stand (FS), emergence rate index (ERI) and electrical conductivity (EC) of tobacco seeds subjected to priming with sodium hypochlorite.

NaClO concentration (%)	Priming time (min)	IS (%)	FS (%)	ERI (%)	EC ($\mu\text{S}\cdot\text{cm}^{-1}\cdot\text{g}^{-1}$)
1.00	180	85 *	87 *	7.99 *	695.42
	60	62	69	5.84	1328.23
	30	82 *	89 *	7.71 *	845.86
	15	86 *	92 *	8.31 *	845.98
	05	79	84 *	7.50 *	910.37
0.50	180	78	87 *	7.64 *	613.71
	60	60	86 *	6.44	3610.57 *
	30	76	88 *	7.12	554.52
	15	62	79	6.36	748.84
	05	76	82	7.17	669.27
0.25	180	72	88 *	6.71	694.62
	60	79	85 *	7.51 *	2170.35 *
	30	54	87 *	6.28	554.87
	15	54	84 *	5.81	558.83
	05	76	82	7.38 *	848.41
0.10	180	60	88 *	6.47	741.48
	60	51	86 *	6.28	882.33
	30	64	83	6.54	543.18
	15	68	74	6.29	784.90
	05	50	78	5.72	824.81
Control		57	80	5.47	1601.70
DMS		23.43	14.23	1.89	101.10

The values followed by * differ from the control by the Dunnett's test at 5% probability.

Conclusions

The priming with sodium hypochlorite does not affect germination, but allows a higher rate and speed of emergence when using the 1% concentration for 180, 30 and 15 min.

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