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Coriander (Coriandrum sativum l.) seed quality as affected by accelerated aging and subsequent hydropriming

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Abstract

Hydropriming is one of the seed germination enhancing techniques which is simple, safe, non-chemical and harmless to the environment. The aim of the present study was to investigate the effect of hydropriming on the germination and vigor of aged coriander (*Coriandrum sativum* L.) seeds. Seeds were aged at 42°C and 100% relative humidity for 0, 24, 48, 72 and 96 h and then primed by soaking in distilled water for 8 h and incubated at 20°C for 24 h, compared to non-primed seeds as control. Results obtained showed that primed seeds resulted in earlier germination and higher first count, germination percentage than those of non-primed seeds, irrespective of aging duration. Seeds aged for 0, 24 and 48 h with subsequent priming or non-priming showed high germination percentages but these were not significant difference among treatments. Increased aging duration to 72 h resulted in decreased germination percentages and primed seeds revealed higher germination percentages than those of non-primed seeds. However, the lowest germination percentage occurred in 96 h aged seeds, with priming or non-priming.

Keywords : *Coriandrum sativum* L., hydropriming, deterioration

Introduction

Coriander (*Coriandrum sativum* L.), belonging to the Umbelliferae (Apiaceae) family, is an annual herb. It is mainly cultivated for the seeds, where as the leaves are used as a garnish (Kiralan et al., 2009). The typical staggered flowering behavior of coriander resulted in

variable fruit formation and leading to slow and uneven germination in coriander seeds (Rubatzky et al., 1999). The highest seed vigor normally established during the physiological maturity and then successively declined or deterioration sequentially occurred depending on storage conditions and chemical component of the seeds. Vigor deterioration might be alleviated to some extent by priming techniques (Szafirowska et al., 2002). Hydropriming is one of techniques for improving seed performance by soaking seeds in water to initiate the early events of germination but not sufficient to permit radicle protrusion followed by drying (McDonald, 2000). This technique could improve speed and uniformity of germination, particularly under adverse conditions, since the first steps of the germination process such as leakage of inhibiting substances, repair of free radical damage to membranes, breakdown of reserves, build-up of enzymes necessary for endosperm breakdown during the priming treatment (Copeland and McDonald, 1995; Bruggink, 2005). Hydropriming has been successfully demonstrated to improve germination and emergence of many vegetable seeds such as cauliflower (Powell et al., 2000), watermelon (Huang et al., 2002), pepper, aubergine (Demir and Okcu, 2004) and tomato (Badek et al., 2006). Hydropriming in coriander seeds has been reported by Rithichai and Pipatkornsakul (2008) and the results revealed that soaking seeds in distilled water for 8 h and incubated at 20oC for 24 h followed by drying for 5 days at ambient temperature was effective to hasten germination. However, hydropriming of coriander seeds after accelerated aging has not been reported yet. Therefore, the aim of the present study was to investigate the effect of hydropriming on the germination and vigor of aged coriander seeds.

Materials and Methods

Plant material

Coriander seeds cv. Saisamon were obtained from East West Seed Co., Thailand.

Accelerated aging and hydropriming treatment

Seeds were placed at 42°C in tightly-closed boxes with tap water at the bottom in order to obtain 100% relative humidity and aged for 0, 24, 48, 72 and 96 h. The aged seeds were primed by soaking in distilled water for 8 h at ambient temperature (30-35°C) and incubated at 20°C for 24 h (Rithichai and Pipatkornsakul, 2008), compared to the non-primed seeds as control. The hydrated seeds were dried for 5 days at ambient temperature (30-35°C).

Germination test

Standard germination was carried out in plastic box (10x15x6 cm) containing moist pleated paper. A replicate consisted of a single box with 100 seeds. There were 4 replicates for each treatment combination. The plastic boxes were incubated at 20/30°C alternating temperatures with 8/16 h light/darkness regime and illumination provided by white fluorescent tubes. Seedlings were evaluated at 7 and 21 days after sowing and the mean normal seedlings, abnormal seedlings, fresh seeds and dead seeds were calculated (ISTA, 1999).

Seed vigor

The germination first count test was performed with the standard germination test, the percentage of normal seedlings was recorded at 7 days after sowing. Mean time to emergence (MTE) and mean time to germination (MTG) were evaluated. Seeds were germinated in the same procedure as standard germination test. Normal seedlings and the germinated seeds with radicle protrusion were counted daily until 21 days after sowing for MTG and MTE, respectively. MTG and MTE were calculated according to Geneve (2005).

Analyses

Data analyses were performed using SPSS. The 2x5 factorial in completely randomized design was used in this experiment. The means were compared by Duncan's multiple range test (DMRT) at 0.05 confidence level.

Results and Discussion

Coriander seeds subjected to various durations of accelerated aging maintained high germination ability until 48 h of aging. Seeds aged for 72 and 96 h showed significant and continued loss of germination as the germination percentage dropped from initial 94.00±3.56% to 71.00±5.89% and 74.00±6.48% at 72 and 96 h of aging, respectively (Table 1). For seed vigor the deteriorating effect of aging was noticed from 48 h and accelerated aging affected first count rather than MTE and MTG. First count of germination rapidly decreased from initial 35.25±2.22% to 21.25±5.12% at 48 h of aging. These results indicated that accelerated aging affected seed vigor rather than germination.

Hydropriming enhanced germination and vigor of both aged and non-aged seeds, with the effect being dependent on seed vigor. Seeds aged for 0, 24 and 48 h with subsequent priming or non-priming showed high germination percentages and there were not significantly different among treatments. Increased aging duration to 72 h resulted in decreased germination percentages and primed seeds had germination percentages higher than non-primed seeds. However, the lowest germination percentage occurred in 96 h aged seeds, with priming or non-priming and there were not significantly different between treatments. In the case of seed vigor, seeds aged for various durations with subsequent priming markedly improved first count of germination, MTE and MTG. First count of aged seeds with subsequent priming was germinated in the range of 46.25±3.77% to 84.75±3.77% but those of non-primed seeds were from 18.25±5.91% to 35.25±2.22%. Aged seeds with subsequent priming emerged within 3.45±0.36 to 5.39±0.29 days, while it took 5.44±0.24 to 6.71±0.24 days in those of non-primed. MTG showed similar trend as MTE with a little longer time for germination.

In general, initial seed quality plays an important role for priming to be successful and priming of high quality seed lots results in an optimum response (McDonald, 2000). Based on this study, priming could reinvigorate aged coriander seeds, particularly 24 and 48 h aged seeds which showed higher quality than those of 72 and 96 h. These results were consistent with those of Bailly et al. (1998) that osmopriming of sunflower seeds previously artificially aged for 5 days, which remained viable, progressively restored their germination capacity. The similar results were obtained in onion seeds that matriconditioning improved germination of aged onion seeds and the more deteriorated seeds showed the less successful to enhance germination (Szafirowska et al., 2002). Priming of aged seeds improved germination capacity and led to full restoration of the cell detoxifying mechanisms which were strongly altered during aging (Bailly et al., 1998).

Table 1: Effects of hydropriming on germination percentage, first count of germination, mean time to emergence (MTE) and mean time to germination (MTG) of the aged seeds for various aging durations.

Aging duration (h)	Hydropriming[1]	%Germination	1st count	MTE (days)	MTG (days)
0	NP	94.00 ± 3.56 ab	35.25 ± 2.22 d	6.10 ± 0.34 ab	8.89 ± 0.31 a
	P	95.00 ± 1.83 a	84.50 ± 4.93 a	3.45 ± 0.36 f	6.29 ± 0.29 d
24	NP	91.75 ± 3.86 ab	31.25 ± 7.18 d	6.71 ± 0.24 a	8.84 ± 0.22 a
	P	94.50 ± 2.65 ab	84.75 ± 3.77 a	3.87 ± 0.36 ef	6.47 ± 0.22 d
48	NP	91.25 ± 5.44 ab	21.25 ± 5.12 e	6.06 ± 0.83 bc	8.89 ± 0.23 a
	P	95.50 ± 2.08 a	69.00 ± 2.58 b	3.61 ± 0.27 ef	7.17 ± 0.18 c
72	NP	71.00 ± 5.89 c	18.50 ± 3.70 e	5.55 ± 0.52 bcd	8.69 ± 0.18 a
	P	88.25 ± 3.59 b	70.75 ± 5.56 b	4.18 ± 0.40 e	6.87 ± 0.12 c
96	NP	74.00 ± 6.48 c	18.25 ± 5.91 e	5.44 ± 0.24 cd	8.93 ± 0.18 a
	P	76.00 ± 0.82 c	46.25 ± 3.77 c	5.39 ± 0.29 d	7.76 ± 0.20 b
ANOVA					
Aging duration (A)		**	**	**	**
Hydropriming (B)		**	**	**	**
AXB		**	**	**	**

[1] NP: non-priming, P: priming

Means ± S.D. within each column followed by the same letters are not significantly different at P<0.05 level by DMRT.

Conclusions

The longer duration of accelerated aging resulted in delay germination of coriander seeds. Priming improved speed of germination in aged seeds but was not so effective to enhance germination percentage particularly in 72 and 96 h aged seeds.

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