EFFECT OF COATING TEMPRATURE AND TIME ON GERMINATION FOR SOME MEDICAL AND AROMATIC-CROP SEEDS

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ABSTRACT

The objective of this paper is to study the effect of coating temperature and its duration on germination percentage of some medical and aromatic crops (fennel, caraway, coriander, nigella and guar) seeds. The main results in this study can be summarized in the following points:

The fennel, caraway, coriander, nigella and guar seeds germination decreased by 22.5 – 22.9, 22.8 – 24.4, 18.9 – 29.8, 20.1 – 27.5 and 18.1 – 23.7 % by increasing coating temperature from 40 to 70 C^o. Meanwhile, the fennel, caraway, coriander, nigella and guar seeds germination decreased by 16.7 – 35.4, 17.1 – 36, 16.6 – 32.3, 15.2 – 32.2 and 14.3 – 29.8 % by increasing coating time from 30 to 60 min.
The maximum fennel, caraway, coriander, nigella and guar seeds germination of 98.1, 96, 98, 100 and 100 % were obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum fennel, caraway, coriander, nigella and guar seeds germination of 63.38, 61.43, 66.3, 67.76 and 70.2 % were obtained with coating temperature of 70 C^o and coating time of 70 min.

INTRODUCTION

Seeds vary greatly in size, shape and color. In many cases, seed size is small or irregular, making singularization and precision placement difficult. In addition, seeds should be protected from a range of pests that attack germination seeds or seedlings. Seed-coating technologies can be employed For two purposes: they can facilitate mechanical sowing to achieve uniformity of plant spacing, and can act as a carrier for plant protectants. So materials can be applied in the target zone with minimal disruption to the soil ecology and environment (Taylor et al., 1998).

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Film coating is a method adapted from the pharmaceutical and confectionery industries for uniform application of materials to seeds. The film forming formulation consists of a mixture of polymer, plasticizer and colorants (Halamer, 1998 and Robani, 1994), and formulations are commercially available that are ready-to-use liquids or prepared as dry powders (Ni, 1997). Application of the film-forming mixture results in uniform deposition of material on each seed with little variation among seeds (Halmer, 1998). The formed film may act as a physical barrier, which has been reported to reduce leaching of inhibitors from seed coverings and may restrict oxygen diffusion to the embryo (Duan and Burris, 1997). A standard pelleting pan has been adapted for application of film-coating polymers, and drying is achieved by applying forced warm air into the coating pan (Taylor and Eckenrode,1993). A small-scale. fluidized bed seed-coating apparatus has been described with controlled air velocity and temperature (Burris et al., 1994). Film coating is routinely performed in vented or perforated pans on a large-scale basis either on a batch or continuos system (Halmer, 1998 and Robani, 1994). The introduction of a continuous process vented-drum coating machine by Coating Machinery Systems (Huxely, Iowa) has expanded the use of film coating. This equipment is capable of continous application of various polmyer systems and components, while providing drying capacity to prevent the seed from hydrating. Capacities vary from 100 to 10 000 kg/h depending on seed type, and target weight gain.

Film coating is versatile as a coating system or a component of a coating system. Colorants as aesthetic appeal to seeds, serve to color-code different verities and increase the visibility of seeds after sowing. Film-coated seeds have better flow characteristics in the planter (Hill, 1997) due to reduced friction between seeds. Film coating provides an ideal method for the application of chemical and / or biological seed treatments (Taylor et al., 1994 and McGee, 1995).

The cultivated area of wheat reached about 61.8 thousand feddan in 2002 that produces about 203.6 thousand ton of grains per year (Agricultural Statistics Economic Affair Sector, 2003).

Yehia (2008) designed a coating machine for crop seeds. It was found that the maximum wheat-grain germination of 98.1 % was obtained with

coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum wheat-grain germination of 38.3 % was obtained with coating temperature of 70 C^o and coating time of 60 min.

The objective of this paper is to study the effect of coating temperature and duration on germination percentage of some medical and aromatic crop seeds

MATERIALS AND METHODS

Coating machine: The coating machine which designed by Yehia, 2008 was used in this study (fig. 1). The main specifications of this machine are: total height 120 cm, width 56.5 cm, depth 104 cm, and total mass 80 kg. The main coating machine parts are as follow:

(1) Frame: made of steal angle with dimensions of 4 x 4 x 0.4 cm, height of 76.5 cm, width of 43 cm and depth of 80 cm.

(2) Feeding pan or unit: has a cylindrical shape made of stainless steal with diameter of 55 cm, depth of 36 cm and with feeding opening with 37 cm diameter and 5 cm height.

(3) Gear box: with 8.5:1 speed ratio which transmits the motion to feeding unit by countershaft.

(4) Electric motor and power transmission: Electric motor of 1 hp (0.675 kW) and 1400 rpm and four pulleys with 3.8, 25, 6.3 and 19 diameters and belts.

Crop seeds: Fennel (Foeniculum), caraway (Curum), coriander, nigella and guar seeds were tested in this study.

Arabic gum solution: with 50 concentration was used.

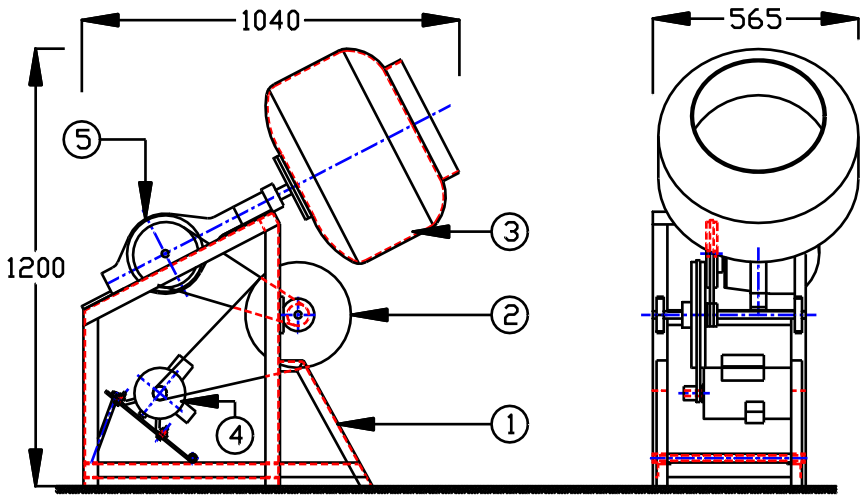
Seed batch: of 5 kg was used.

Coating-unit speed: of 28 rpm was used.

Coating steps:

(1) The wheat flour powder of 0.5 kg was spread inside the rotated coating pan (unit) which was heated by heater flame. The temperature of coating pan and grains was controlled by flame intensity.

(2) The medical and aromatic seeds batch (5 kg) was spread inside the rotating coating pan.



(1) frame, (2) idler pulley, (3) coating unit, (4) motor and (5) gear box.

Fig. 1: Sketch and photograph of the coating machine (Yehia, 2008).

(3) Arabic-gum solution with 75 cm^3 volume was spread on the seeds inside coating pan.

(4) The grains were agitated by hand to distribute the Arabic gum.

(5) The wheat flour powder of about 70 g was spread directly after then.

(6) The grains were agitated by hand to distribute the flour powder to add it as a layer around the grains.

(7) The steps from 3 to 6 were repeated until finishing the first layer. The first layer needs 1 : 2 powder seeds ratio.

(8) The seeds exit from coating pan and spread in the air to dry.

(9) The dried coated-seeds were put inside coating pan.

(10) The steps from 3 to 6 were repeated until finishing the jacket layer. The jacket layer needs 0.3 : 1 wheat-flour powder seeds ratio.

(11) The grains exit from coating pan and spread in the air to dry.

RESULTS AND DISCUSSION

Effect of coating temperature and time on germination of fennel seeds.

Table 1 and fig. 2 show that the fennel seeds germination decreased by 22.5 – 22.9 by increasing coating temperature from 40 to 70 C^o.

The maximum fennel seeds germination of 98.1 % was obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum fennel seeds germination of 63.38 % was obtained with coating temperature of 70 C^o and coating time of 70 min.

Effect of coating temperature and time on germination of caraway *seeds.*

Table 1 and fig. 2 show that the caraway seeds germination range decreased from 74.1 - 96 to 61.43 – 81.23 % by increasing coating temperature from 40 to 70 C^o.

The maximum caraway seeds germination of 96 % was obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the

minimum caraway seeds germination of 61.43 % was obtained with coating temperature of 70 C^o and coating time of 70 min.

Table 1: Effect of coating temperature and time on germination of some medical and aromatic seeds.

Seed type	Coating temperature, c^0.	Germination ratio, %.		
		Coating time, minute.		
		30	45	60
Fennel	40	98.1	92.3	82.17
	50	95.1	88.6	74.96
	60	93.95	81.06	68.15
	70	76.05	70.01	63.38
Caraway	40	96	85.17	81.23
	50	89.35	86.13	69.84
	60	81.06	79.13	70.45
	70	74.1	66.3	61.43
Coriander	40	98	96.5	94.5
	50	86.4	83.16	71.78
	60	80.09	76.24	70.93
	70	79.46	73.13	66.3
Nigella	40	100	99.44	93.5
	50	91.11	80.19	79.54
	60	82.03	78.18	69.19
	70	79.95	71.18	67.76
Guar	40	100	92.11	92.01
	50	93.2	87.12	83.42
	60	82.99	78.5	71.41
	70	81.9	76.05	70.2

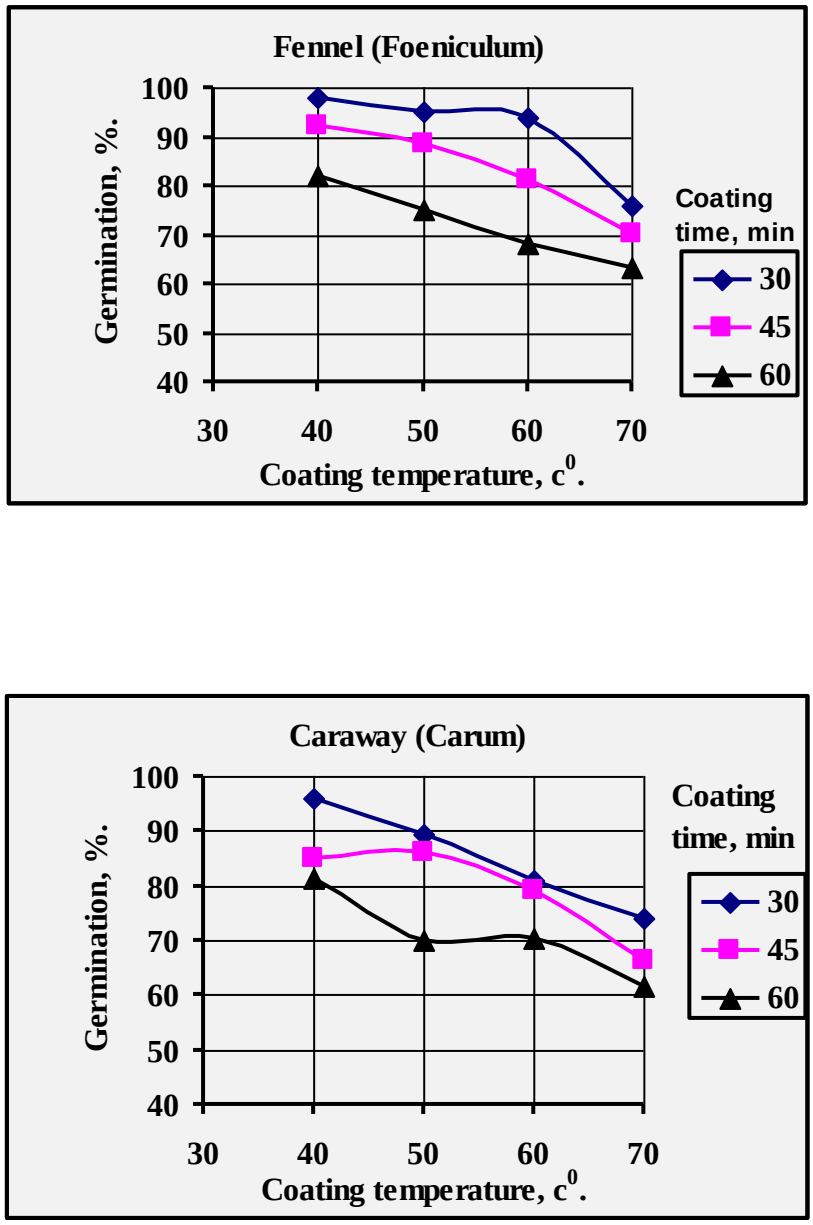


Fig. 2: Effect of coating temperature and time on germination of funnel and caraway seeds.

Effect of coating temperature and time on germination of coriander seeds.

Table 1 and fig. 3 show that the average coriander seeds germination decreased from 86 to 75.9 % by increasing coating temperature from 40 to 70 C^o.

The maximum coriander seeds germination of 98 % was obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum coriander seeds germination of 66.3 % was obtained with coating temperature of 70 C^o and coating time of 70 min.

Effect of coating temperature and time on germination of nigella seeds.

Table 1 and fig. 3 show that the average nigella seeds germination decreased from 88.3 to 77.5 % by increasing coating temperature from 40 to 70 C^o.

The maximum nigella seeds germination of 100 % was obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum nigella seeds germination of 67.76 % was obtained with coating temperature of 70 C^o and coating time of 70 min.

Effect of coating temperature and time on germination of* guar *seeds.

Table 1 and fig. 3 show that the average guar seeds germination decreased from 89.5 to 79.3 % by increasing coating temperature from 40 to 70 C^o.

The maximum guar seeds germination of 100 % was obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum guar seeds germination of 70.2 % was obtained with coating temperature of 70 C^o and coating time of 70 min.

CONCLUSION

The maximum fennel, caraway, coriander, nigella and guar seeds germination of 98.1, 96, 98, 100 and 100 % were obtained with coating temperature of 40 C^o and coating time of 30 min. Meanwhile, the minimum fennel, caraway, coriander, nigella and guar seeds germination of 63.38, 61.43, 66.3, 67.76 and 70.2 % were obtained with coating temperature of 70 C^o and coating time of 70 min.

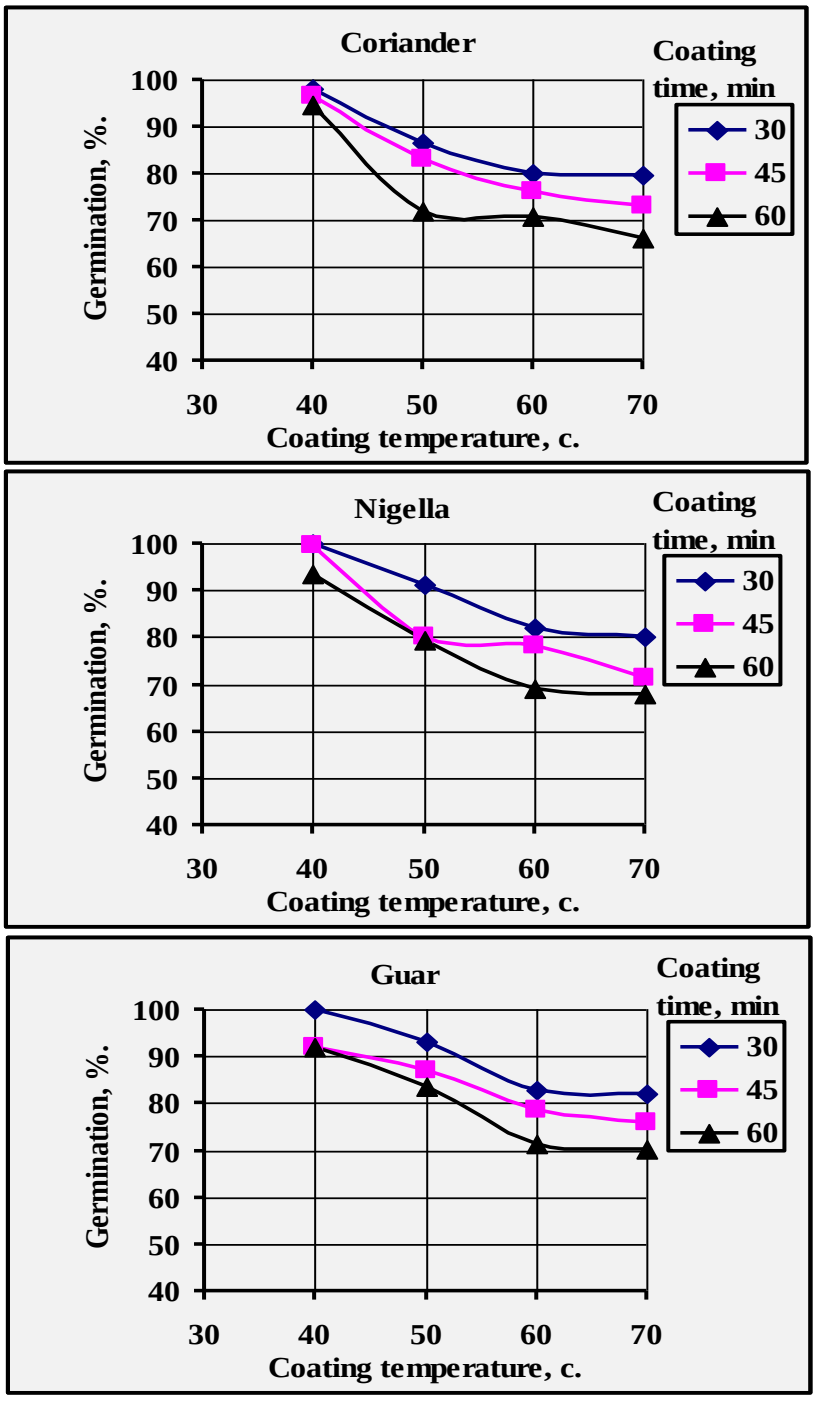


Fig. 3: Effect of coating temperature and time on germination of coriander, nigella and guar seeds.

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الملخص العربى

تأثير درجة حرارة وزمن التغليف على إنبات بعض بذور النباتات الطبية والعطرية

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يهدف هذا البحث إلى دراسة تأثير درجة حرارة وزمن التغليف على إنبات بعض بذور النبتات الطبية والعطرية (الشمر، الكراوية، الكزبرة، حبة البركة، الجوار). وتم الحصول على النتائج التالية:

تم الحصول على أعلى نسبة إنبات لبذور الشمر، الكراوية، الكزبرة، حبة البركة، الجوار ٩٨,١، ٩٦، ٩٨، ١٠٠، ١٠٠% عند استخدام درجة حرارة تغليف ٤٠ ^{0} م، زمن تغليف ٣٠ دقيقة. تم الحصول على أقل نسبة إنبات لبذور الشمر، الكراوية، الكزبرة، حبة البركة، الجوار ٦٣,٤، ٦١,٤، ٦٦,٣، ٦٧,٨، ٧٠,٢ % عند استخدام درجة حرارة تغليف ٧٠ ^{0} م، زمن تغليف ٦٠ دقيقة.

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