SOLAR DRYING OF CORN FOR SEEDS PRODUCTION

By

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B.Sc. Agric. Sc. (Agricultural Engineering), Ain Shams University, 2011

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ABSTRACT

Gehad Abd-alfattah Abd-alaziz Morsy: Solar Drying of Corn for Seeds Production. Unpublished M.Sc. thesis, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University, 2017.

This study was carried out to compare the effect of two different drying methods on drying corn. The experiments were carried out in rice mechanization center at Meet El- Dyba, Kafr El- Sheikh Governorate, Egypt during summer 2016. The experimental measurements included Solar radiation in and out the dryer, ambient air temperature and its relative humidity, air dryer temperature and its relative humidity, grain bulk temperature, moisture content, drying rate, thermal efficiency and quality tests of dried grain. Ear and shelled corn was dried by using solar energy for heating air inside a greenhouse and compared with natural sun drying method. Results indicated that the times required to reduce the moisture content from 31.73%(d.b) to 14.07%(d.b) were 26, 24 and 28 hours for solar drying at air velocities of 0.5, 1.0 and 1.5 m/s respectively as compared to 46 hours for natural sun drying method for complete ear corn. The corresponding drying times for shelled corn were 12, 10 and 14 hours to reduce the moisture content from an initial level of 27.23% to 19.97% (d.b.) as ear corn, and 8, 6 and 10 hours to reduce the moisture content from 19.97% to final level of 14.12%(d.b.) as shelled corn at air velocities of 0.5, 1.0 and 1.5m/s respectively as compared to 38 hours for natural sun drying method. The results of quality tests that included standard germination test, vigor test and tetrazolium test for two drying methods for ear and shelled corn recorded high percentages for all treatments except solar dried ear corn at air velocities (0.5 and 1.0 m/s). The average air temperature inside the solar dryer at air velocities of 0.5 and 1.0 m/s reached to 43.5 and 42.5 ˚C respectively. High temperatures killed the germ so the quality tests reduced. Germination percentage of dried ear corn by natural sun drying and solar drying at air velocities (0.5,

1.0 and 1.5 m/s) was 97, 79, 81 and 89% respectively. The corresponding values for dried shelled corn were 95, 97, 93 and 98%. The vigor test of dried ear corn recorded 90, 34, 45, and 66% for natural sun drying and solar drying at air velocities of 0.5, 1.0 and 1.5 m/s respectively. The corresponding values for dried shelled corn were 82, 86, 96, and 97% respectively. The observed high level of quality tests for shelled corn could be attributed to the reduction of drying air temperature during drying period. Hourly costs of ear corn drying were 0.95, 0.88, 1.00 and 1.03 L.E/ kg for solar drying at air velocities 0.5, 1.0 , 1.5m/s and natural sun drying respectively. The corresponding values for shelled corn were 0.74, 0.58, 0.89 and 0.98 L.E/ kg. **Main object of this study:** The main object of this study is to study the ability of utilizing greenhouse solar dryers for drying corn in order to obtain the best quality of dried grains for using it as seeds with the least drying time, and comparing with the natural sun drying method. The experiments were carried out under two different operating conditions of two different drying methods (solar drying method using greenhouse solar dryer -natural sun drying method), two different plant conditions (ear corn- shelled corn) and three different air velocities (0.5, 1.0 and 1.5 m/s).

Key words: Drying process, Solar energy, Sun drying, solar drying, Seeds production, Corn drying

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To Soul of **Prof. Dr. Mahmoud Ahmed El-Nono** and My Dear Sister **Ph. Doaa Abdalfattah Abdalaziz**.

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LIST OF ABBREVIATIONS

Prof.	:	Professor
Emer.	:	Emeritus
Agric.	:	Agriculture, Agricultural
Eng.	:	Engineering
Fac.	:	Faculty
Univ.	:	University
AOAC	:	Association of official analytical chemists
Mc	:	Moisture content
$\mathbf{M_t}$	:	Moisture content (Kg water/ Kg dry matter) at time t
$\mathbf{M_{t+dt}}$	:	Moisture content (Kg water/ Kg dry matter) at time t +dt
dt	:	Time difference, hr
Q	:	Solar energy available inside the solar dryer
R	:	Solar radiation flux incident inside the solar dryers, W/m^2
$\mathbf{A_d}$	:	Net surface area of the drying chamber, m^2
$\mathbf{Q_C}$	:	Useful heat gain by the dryer during the drying process
$\mathbf{m_a}$	:	Air flow rate, Kg/s
$\mathbf{C_P}$	:	Specific heat of air, J/Kg.˚C
$\mathbf{T_{ai}}$	:	Air temperature inside the dryer,˚C
$\mathbf{T_{ao}}$	:	Ambient air temperature outside the dryer, ˚C
V	:	Air velocity, m/s
A	:	Cross section area of the window of the dryer, m^2
P	:	Air density, Kg/m^3