The effect of drying land on the character of corn (Zea mays) on lightness properties

M Hadipernata1*, A N Al-Baarri2,3, M Somantri4, J Munarso1, R Rachmat1, E Rahayu1, A F Pratiwi2, B Setyadi2, A A Mawarid5, W Pangestika2 and F P Lestari6

1 Center for Post Harvest Agricultural Research and Development Bogor
2 Food Technology Department, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Indonesia
3 Integrated Laboratory Unit, Diponegoro University, Semarang, Indonesia
4 Electrical engineering Department, Faculty of Engineering, Diponegoro University, Semarang, Indonesia
5 Nutrition Science Department, Faculty of Medical, Diponegoro University, Semarang, Indonesia
6 Chemical Engineering Department, Faculty of Engineering, Diponegoro University, Semarang, Indonesia

*E-mail: albari@live.undip.ac.id

Abstract. Corn is one of the most popular agricultural commodities in Indonesia. As a traditional farming system, the corn was then dried under the sun after harvesting resulting in the specific appearance. This research was aimed at determining the lightness in corn after the dry process using the oven. The corn after harvesting in 120 days was transferred to the laboratory and oven-dried at 38-43˚C for 7 days. Based on the research conducted, the lightness of the corn experienced changing day by day and through the detection using lightness value, the decrease could be determined. The conclusion of this study was that the longer the drying caused the reduction in lightness of the corn.

1. Introduction
Corn is one of the national commodities which has large production in Indonesia and might be used as a substitute for staple food [1]. Corn is easy to grow in tropical climates and also easy to cultivate sustainably [2] and the product may be used as animal feed [3]. Hybrid corn was developed and has a harvesting time of about 120 days, with a drying time of 1 week in the field under the sun and 3 days when it is peeled [4]. This type of corn is prone to quality degradation, especially after harvesting, therefore it is necessary to have good post-harvest handling. Colorimeter is a tool used to test color difference. The colorimeter has 3 parts, namely L * a * b, where L is the part to describe the level of brightness with a value of 0 for black and 100 for white, * a to describe the type of green-red color with negative values for green and positive for red, * b to describe blue-yellow with negative values for blue and positive for yellow. The purpose of this study was to determine the characteristics of maize from the corn color index.
There are several factors that may increase the quality of corn, one of them is drying method [5]. In previous studies, it can be shown that the lower the value of the convection heat transfer coefficient can prevent damage to the corn so that it could maintain the quality of the dried corn [6]. Since it is cheap, the drying under the sun was done by a farmer, but it retained several problems, such as dependence on weather, long drying time, and easy contamination [8]. Previous studies have stated that drying could be done by an oven that might reduce the rate of deterioration in corn quality [9]. However, oven drying has several disadvantages or risks, such as the degradation in color of the corn.

2. Material and methods

2.1 Material
This research was conducted at the Integrated Laboratory Unit, Diponegoro University, Semarang. The material used is corn obtained from Sukomangli Village, Patean District, Kendal Regency, Central Java. The tools used are plastic, container boxes, ovens, and colorimeters from the Integrated Laboratory Unit, Diponegoro University, Semarang, Central Java.

2.2 Method
2.2.1 Corn preparation. This study used 120 days corn (Zea mays) obtained from Sukomangli Village, Kendal Regency, Central Java. Corn in the form of cobs and still weighed taken from the land is put into plastic and container boxes that have been sterilized and then taken to the location of the Integrated Laboratory Unit of Diponegoro University. Corn was shelled and dried as in previous studies using an oven temperature of 40-50°C [10].

2.2.2. Lightness testing. Corn stored in the oven was observed by measuring the luminosity coefficient value of L * on the yellow and white color of the corn kernels at different points using a digital color measuring device (Colorimeter).

3. Results and discussion
Color change testing is one of the parameters carried out to see the extent to which the product has decreased in quality [11]. The decreasing color intensity indicates that the corn has increased in quality so this study uses one of the color parameters, namely Lightness. Color change assessment was carried out using a colorimeter, where the luminosity coefficient, L *, ranged from 0 = black and 100 = white [12].

Figure 1. Color of the corn kernels.
Based on Figure 2. It is known that the L* value in maize fluctuates, in previous studies it was stated that the color index can experience fluctuating changes caused by drying [13]. The L* value in yellow corn kernels decreased by 7.66% while the white color of corn kernels was 14.29%. This is consistent with previous studies which stated that heat in the drying process can cause discoloration [14]. The temperature and time used during the drying process can affect the decrease in L* value [15]. The decrease in lightness (L*) value in maize can also be caused by a decrease in the carotenoid pigments found in corn kernels. Previous research stated that the lightness value, especially the yellow color of corn kernels, was influenced by the presence of maltose and glucose. During the drying process in the oven, maltose and glucose will reduce the carotenoid color pigments found in corn kernels [16]. Based on the initial and final values, drying the oven was able to inhibit the decline in the quality of the maize.

4. Conclusion
Based on the research results, it can be concluded that drying is the right technique / step in maintaining the characteristic of corn. The lower the Lightness value, the higher the characteristic of the corn. Drying temperature, drying time is one of the factors that can affect the decrease in lightness value.

References
[1] Aldillah R 2017 Maize agribusiness development strategy in Indonesia J. Agricultural Policy Analysis 15 43-66
[2] Noto Susanto A N and M P Sirappa 2005 Prospects and strategies for corn development to support food security in Maluku J. Agricultural Research and Development 24 70-79
[3] Hidayat A, S A Andayani and J Sulaksana 2017 Analysis of corn supply chain (case study of hybrid corn supply chain (Zea mays) in Cicurug Village, Majalengka District, Majalengka Regency) J. Agricultural and Animal Sciences 5 1-14
[4] Muhammad M 2014 Corn crop agribusiness development strategy in North Halmahera District agriculture office J. Scientific Agribusiness and Fisheries 7 58-65
[5] Sinaga A S 2019 Segmentasi Ruang Warna L*a*b J. Mantik Penusa 3 43-46

Figure 2. The L* value of corn kernels dried in the oven for 7 days.
[6] Arsyad M 2018 Effect of drying on the rate of decrease in moisture content and weight of corn (zea mays) for variety of BISI 2 and NK22 J. Agropolitan 5 44-52
[7] Bintoro N, Gunadi S, Nugroho J and Trust H Z 2012 Heat and mass transfer mechanical drying process method of dryeration using silo beraerator National Seminar Proceedings (July 13-14).
[8] Ratnawati M A G, Fernandy and Buchori L 2012 the effect of drying air temperature and 3a zeolite composition on grain drying time in fluidized bed dryer J. Momentum 8 6 –10
[9] Djaeni M, Asia N and Sasongko S B 2015 Application of Adsorption Drying System for Food and Additives (UNEES Press: Semarang)
[10] Syahrul S, Rhomdani R and Mirranto M 2016 The effect of air velocity variation and material mass on corn drying time in fluidized bed tool J. Mechanical Engineering Dynamics 6 119-126
[11] Nino J 2018 Analysis of the quality and levels of corn aflatoxin in natural air drying J. Dryland Conservation Agriculture 3 58-60
[12] Rahman T P, Sukarto A, Rochman N T and Manaf A 2013 synthesis of iron oxide pigments made from steel industry waste (mill scale) J. Physics 3 86-89
[13] Risdianti D, Murad and Putra G M D 2016 The study of drying ginger (zingiber officinale rosc) based on geometric and color changes using image analysis method. J. Ilmiah Rekayasa Pertanian dan Biosistem 4 275 – 284
[14] Saikaew K, Lertrat K, Meenune M and Tangwongchai R 2018 effect of high-pressure processing on color, phytochemical contents and antioxidant activities of purple waxy corn (Zea mays L. var. Ceratina) kernels J. Food Chemistry 243 328 - 337
[15] Odjo S, Malumba P, Dossou J, Janas S and Bera F 2012 Influence of drying and hydrothermal treatment of corn on the denaturation of salt-soluble proteins and color parameters J. Food Engineering 109 561 - 570.
[16] Sahilatua S O, Suter I K and Wiadnyani A A I S 2019 The effect of harvest age on characteristics of white pulut corn flour (Zea Mays Var. Ceratina) J. Food Science and Technology 8 430-439