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Blanching black peppercorns (*Piper nigrum*): A post-harvest intervention for quality berries

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Abstract

A study on post-harvest by blanching black pepper berries was conducted to determine the quality of black pepper as to: (1) moisture content and final weight of peppercorns after drying, (2) grinding quality, and (3) the presence of molds and yeasts on peppercorns. It was conducted at the black pepper plantation located at Alipang Site, Rosario, La Union. One kilogram harvested pepper corns per treatment was used as experimental unit**.** The study was laid out in a Randomized Complete Block Design (RCBD); different blanching duration as treatment (T_0- no blanching, T_1- 1-minute blanching, T_2- 4 minutes blanching, T_3- 7 minutes blanching, T_4- 10 minutes blanching). Each treatment was replicated thrice. Black pepper blanched for 1 minute (T_1) had the highest dried yield with a mean reading of 38.77% and has a comparable reading with black pepper blanched for 7 minutes (T_3) with a mean reading of 37.70%. Blanched black pepper berries, regardless of time duration showed high percentage of recovery from fresh to dry as compared to normal or traditional recovery of about 26% to 39% of black pepper production. No significant differences among the treatment means was observed as to the moisture content. But four minutes blanching reduced the presence of mold and totally eliminated the same at longer blanching period. The yeast population was not affected by blanching duration.

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Introduction

Black pepper (*Piper nigrum*) has been identified as the most common and widely used spice worldwide (FAO Statistics Division, 2015). In the Philippines, it is mainly produced in the provinces of Batangas and Cavite. The local supply of black pepper does not meet the demand required, thus the country imports from Vietnam, Italy, India, and South Korea (Philippine Statistics Authority, 2019). However, black pepper is also one of the high value crops produced in Region 1, Philippines.

Drying has been used traditionally to prolong spices' shelf life by reducing its moisture content. However, drying black peppers under the sun and in an open environment subjects the spice to microbial contamination and graying of the products. The quality of locally produced black peppers must meet the consumers' preferences. Generally, black and waxy peppercorns are most preferred by consumers. Therefore, blackening is considered to be beneficial and important in the processing of black pepper which also contributes to the color and flavor of black pepper. Moreover, commercialization of black pepper is generally regulated by its quality which involves the pungency, color, and fresh aroma. These quality attributes depend on the post-harvest processing techniques which mainly include blanching and drying (Gu *et al.,* 2018). Blanching and drying techniques are widely used in other countries but it may not be the case in the Philippines.

Blanching is the process of dipping in boiling water and is an effective pre-treatment for different herbs (Thamkaew *et al.,* 2020). Blanching speeds up the drying rate of black pepper compared to sun-drying alone. It is also beneficial since boiling the products can remove impurities and possible microbial contaminants (Weil *et al.*, 2017; Vandeweyer *et al*, 2017). However, researches conducted showed that prolonged blanching at certain temperatures can negatively affect the quality of black peppers (Mey *et al.*, 2017; Suchana *et al.*, 2021; Wang *et al.*, 2017). There are already blanching duration and temperature recommended for black pepper according to researches but these are conducted in other countries which might not be applicable locally. The black pepper varieties used also differ from one place to another.

The lack of researches in local black pepper in the country shows the need for improved research undertakings for this highly potential crop. Thus, this study will try to determine the effect of blanching duration on the quality of black pepper berries

Materials and methods

Research Design

The study was laid out in a Randomized Complete Block Design (RCBD) with different blanching duration as treatment as follows: To- no blanching, T1- 1-minute blanching, T2- 4 minutes blanching, T3- 7 minutes blanching, T4- 10 minutes blanching. Matured black pepper berries used in the study were gathered from the existing plantation of the College of Agriculture at Alipang, Rosario, la Union.

Harvesting, cleaning, weighing and packing of black pepper

The black pepper plants with mostly green berries and with 1-2 or more berries turning a brighter color red and hard to touch during the months of February and March were selected, harvested at the same time, and cleaned to ensure a more uniform and of quality berries. One kilogram of black pepper berries was weighed each and properly packed in a fine mesh net then tied and secured (Fig. 1).

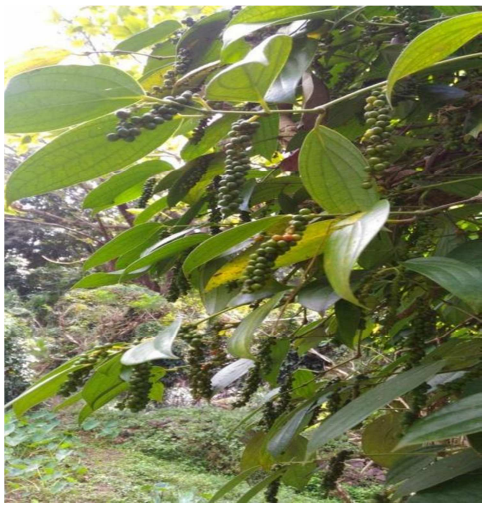

Fig. 1. Harvesting black pepper plants is done by selecting the mostly green berries and with 1-2 or more berries.

Blanching, Drying, winnowing

Water temperature was set and reached 90°C before black pepper blanching was conducted. Blanching was done according to the treatments with water temperature maintained at 90°C during the blanching process. After blanching, the berries were removed from the vat and soaked immediately in a pail filled with cold water, then followed immediately by sun drying from 9:00 o'clock in the morning to 3:00 o'clock in the afternoon. All the treatment samples were dried for five days before winnowing. The peppercorns were then weighed and packed in a plastic container and sealed tightly.

Weighing, Moisture Content reading and Grinding

After winnowing, the peppercorns were weighed to get the recovery rate of black pepper from fresh to dry, moisture content of the peppercorns was measured using the Computer Moisture Bulk Density Tester LK CHIBA 168 (MODEL:8989) followed by grinding using a fruit blender to estimate the percentage of ground peppercorns.

Data Analysis

Data on recovery rate, moisture content, grinding percentage and mold, mycotoxin and yeast count were gathered, tabulated and analyzed. Data were analyzed using Analysis of Variance (ANOVA) in Statistical Tool for Agricultural Research (STAR). Tukey's HSD (honest significant difference) was performed to test further the significant treatment means.

Results and discussions

Table 1 shows the recovery rate of black peppercorns, Moisture Content of dried black pepper (%), Total number of peppercorns (in 10 grams) and Percentage of peppercorns grounds in three seconds (%)

Table 1. Recovery rate (%), Moisture Content (%), Total number of peppercorns (in 10 grams) and Percentage of peppercorns grounds in three seconds (%) of black peppercorns subjected to different blanching time duration.

Treatment (Blanching time)	Recovery rate of black peppercorns. (%)	Moisture Content of dried black pepper (%)	Total number of peppercorns (in 10 grams)	Percentage of peppercorns grounds in three seconds (%)
T_0 – Control (no blanching)	36.80bc	10.60	267.00	85.89b
T_1 – 1 minute	38.77a	10.16	275.00	90.78a
T_2 – 4 minutes	37.00b	10.07	298.00	90.78a
T_3 – 7 minutes	37.70ab	10.20	283.33	92.21a
T_4 – 10 minutes	35.67c	10.27	286.00	89.00ab
	*	ns	ns	*

*Means with the same letter are not significantly different at 5% level by STAR

Recovery Rate of Peppercorn after Drying

Statistical analysis revealed that black peppercorns blanched with 1- minute hot water had the highest dried yield with a mean reading of 38.77% and has a comparable result with black peppercorns blanched in hot water for 7 minutes with a mean reading of 37.70%. Recovery rate of black peppercorns blanched within 7 minutes was significantly higher with black pepper blanched for 10 minutes, no blanching, and for only 1 minute with a mean of 35.67% to 37.00%, respectively. All treatments showed high percentage of recovery of black pepper berries from fresh to dry as compared to

the standard recovery of about 26 to 39 percent in black pepper production. The results coincide with the study of Weil, et al., (2016) mentioned that blanching increased the drying rate thus reducing drying time of *Piper borbonense* (wild pepper).

Moisture Content of Black Pepper

No significant differences were observed in the moisture content of black peppercorns after 5 days of sun drying with a means ranging from 10.07% to10.60%. Black pepper that did not receive blanching had the highest moisture content with a mean of 10.60% compared to the rest of the treatments. Moreover, mean differences ranging from 0.33% to 0.53% were recorded among the treatments. According to vikaspedia in Agriculture, the moisture content of well dried black pepper berries was not more than 11%. Moisture content over this can increase the fungal and insect pest attack.

Blanched dried peppers had moisture content of 5.33% —11.52% while unblanched dried peppers had more than 12% moisture content as cited by Suchana et.al. (2021). Also, Dhas and Korikanthimath (2003) reported that moisture content should be less than 10% to store the product safely after drying. This implies that blanching time has an effect on the drying parameters, storability as well as the moisture content of the black pepper berries.

Total Number of Peppercorns Counted per 10 grams

Total number of peppercorns counted in 10 grams revealed no significant differences among treatments as shown in Table 3. Numerical data revealed that treatment 2 had the highest number of peppercorns counted in 10 grams compared with other treatments. Meanwhile, control treatment (no blanching) markedly had the lowest number of peppercorns counted.

Table 2. Mold and Yeast Count.

Treatment	Point of Reference	Mold Count	YEAST Count
T_0 – Control (no blanching)	0 - 250 CFU/g	280 CFU/g	< 10 CFU/g
T_1 – 1 minute	0 - 250 CFU/g	210 CFU/g	< 10 CFU/g
T_2 – 4 minutes	0 - 250 CFU/g	< 10 CFU/g	< 10 CFU/g
T_3 – 7 minutes	0 - 250 CFU/g	110 CFU/g	< 10 CFU/g
T_4 – 10 minutes	0 - 250 CFU/g	110 CFU/g	< 10 CFU/g

Percentage of Peppercorn ground (%)

Black pepper blanched for 7 minutes had the highest percent of peppercorns ground in three seconds with a mean of 92.21% followed by no blanching black pepper then for 4 minutes and 10 minutes, with a mean of 90.78% and 89.0% respectively. The result could be due to the moisture content of peppercorns in each treatment. The lower is the moisture content the higher is the percentage of peppercorns that was ground. The higher the moisture content the lower is the percentage of peppercorns that was ground.

Mold and Yeast Count

The laboratory analysis for mold and yeast count of the peppercorns is shown in Table 2. The analysis was conducted at the Department of Science and Technology (DOST), Region 1, San Fernando, La Union following the Bacteriological Analytical Manual Online, (2001) Chapter 18 Yeast, Mold and Mycotoxin.

Molds Count as shown in Table 2 revealed that black pepper berries that was not blanched with hot water has 280 CFU/g exceeding the point of reference of 250 CFU/g making it unsafe for human consumption especially if it is not cooked. Black pepper that were blanched before drying have a reading of mold counts ranging from 10 CFU/g – 210 CFU/g, and are within the point of reference from 0-250 CFU/g. This means that it is safe for human consumption. In addition, the yeast was found to be less than 10 CFU/ g which is far below the point of reference, therefore, does not affect the health of human beings.

This implies that blanching of black pepper has a great influence on the quality of black pepper products. Moreover, as cited by Ravindran and Kallaumparackal (2001), blanching techniques clean the product and washing out all kinds of foreign materials and reduces microbes' activity from the

black pepper surface sufficiently (Vandeweyer, Lenaerts, Callens, & Van Campenhout, 2017). This implies further that, the lower the moisture content the lower the mold and yeast count.

During storage, pepper corns are hygroscopic and peppercorns absorb moisture from the weather. That is why moisture levels to 10%-11% may stop mold growth (Thangaselvabal et al., 2008). So, moisture should be maintained in such a way so that microbial attack, chemical change of the product can be minimized (Krokida, Karathanos, Maroulis, & Marinos-Kouris, 2003).

Conclusions

A study was conducted to determine the quality of black pepper as affected by blanching time. Black pepper plantation was located at Alipang Site, Rosario, La Union. One kilogram pepper berries, uniformly green in color, was used as raw material, per treatment**.** The study was laid out in a Randomized Complete Block Design (RCBD) with three replications. The treatments were: T0- control (no blanching), T1- 1-minute blanching, T2- 4 minutes blanching, T3- 7 minutes blanching, T4- 10 minutes blanching. Treatment 1, black peppercorns soaked for a minute had the highest dried yield with a mean reading of 38.77% and has a comparable reading to treatment 3 with a mean reading of 37.70%. All treatments showed a high percentage of recovery of black pepper berries from fresh to dry as compared to the standard recovery of about 26% to 39% percent in black pepper production. There are no significant differences observed in the moisture content of black pepper after 5 days of sun drying and grinding speed of black pepper. Treatment 2, black peppercorns soaked in hot water for 4 minutes had the lower mold and yeast count. Therefore, blanching at any length of time could reduce the mold and yeast count, thus safer for human consumption.

Based from the results of the study: (1) the peppercorns blanched and dried for one minute and seven minutes have the highest recovery rates, (2) no significant differences on the moisture content, and on the grinding quality (total number of peppercorn counted) , (3) while the grinding percentage have higher efficiency when the peppercorns has lower moisture content and (4) the mold count were eliminated when the peppercorns are blanched longer, while the yeast count is not affected by blanching duration.

Recommendation

Blanching of black pepper berries for 1 to 7 minutes before drying is recommended for a higher recovery rate.

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