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Winter wheat noodle colour evaluation in sustainable farming systems

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The aim of this work was to evaluate colour of noodles that were prepared from winter wheat grown in ecological and integrated arable farming systems after different forecrops with two levels of fertilization (fertilized and unfertilized) during the years 2009 and 2010. Winter wheat noodles were prepared from white flour and wholegrain flour and it's colour was evaluated using the spectro-colorimeter. Colour of white flour noodles was significantly influenced by forecrop, crop nutrition (fertilized and unfertilized variants) and by meteorological conditions during experimental years. Farming systems had no statistical effect on white flour noodles colour values. The colour of wholegrain noodles was affected by farming system, forecrop, crop nutrition and also the year of growing. Whole grain noodles from ecological system were darker, with lower lightness, higher redness compared to noodles from integrated system. Fertilization increased redness, yellowness and decrease the lightness of white flour noodles, on the contrary, fertilization increase the lightness and decrease the redness of wholegrain noodles.

Keywords: ecological, integrated arable system, wheat noodle colour

1 Introduction

The key quality attributes in the evaluation of noodles include texture and colour, which are important quality factors since they are associated with flour (Chang, Wu, 2008). Flour extraction rate has an important influence on noodle attributes, especially colour. Studies on dried noodles showed a decline in brightness and increase in yellowness with increased extraction rate (Kruger et al., 1994). Noodle darkening increases with the increase of flour extraction rate. This is due to the action of polyphenol oxidase enzymes which are largely located in the bran layer (Fuerst et al., 2006). Low ash content (1.4 % and less) in flour is always an advantage for noodles since flour ash is traditionally viewed as causing noodle discoloration. Low flour extraction and ash levels are preferred for the manufacture of noodles with a clean and bright appearance. Increased starch damage is associated with poor noodle colour and undesirable high cooking loss and excessive surface swelling (Hatcher et al., 2002). Since colour is a key element of a consumer's buying decisions, it is important to ensure noodle colour options availability on the market.

2 Material and Methods

Field experiments of ecological and integrated arable farming systems were conducted at the Research experimental station of the Faculty of Agrobiology and Food Resources in Nitra during 2009 and 2010 growing periods. Both arable farming systems were composed of six-course crop rotations. Winter wheat was grown within both farming systems, after different forecrops, fertilized and unfertilized variants. Winter wheat noodles were prepared from white flour, obtained after grain milling on the laboratory mill Brabender Quadrumat Senior and from wholegrain flour obtained by grinding on the special mill PSY MP. Egg noodles with

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moisture of 30.5 % produced on the apparatus for pasta producing P3 (La Monferina) were dried at 50 °C for 12 hours. Noodle colour was evaluated using the spectro-colorimeter SP60 which allows very accurate measurement of the basic optical properties of the surface. The CIE (International Commission on Illumination) standardized colour order systems to derive values for describing colour. The CIE Colour Systems utilize three coordinates to locate a colour in a colour space. These colour spaces include CIE L*a*b, which is used to compare the colours of two objects. L* defines lightness, a* denotes the red/green value and b* the yellow/blue value. CIE LAB uses Cartesian coordinates to calculate a colour in a colour space. The a* axis runs from left to right (green (-a) to red (+a)), +a direction depicts a shift toward red. The b* axis is at an angle of 90 degrees to a* axis, +b movement represents a shift towards yellow, -b means a shift toward blue. The center L* axis shows L = 0 (black) at the bottom, L = 100 represents white. Colour evaluation of cooked noodles was carried out in triplicate; analysis of variance was used for statistical evaluation.

3 Results

Farming systems had no statistical effect on **white flour noodles** colour values. Colour of noodles was significantly influenced by forecrop after which w. wheat was grown, by crop nutrition (fertilized and unfertilized variants) and by meteorological conditions during 2009 and 2010 experimental years. Average lightness of white flour noodles was 77.5, average redness (a*) 1.3 and yellowness (b*) 20,9. The darkest noodles, according to L*, were achieved after the forecrop alfalfa, fertilization increased redness (a*) yellowness (b*) and decreased the lightness (L*) of noodles.

The colour of **wholegrain noodles** was affected by farming system, forecrop, crop nutrition and also the year of growing. Average lightness of wholegrain noodles was 56.8, redness 9.1 and yellowness 20.1. Noodles from w. wheat grown in ecological system were darker compared to noodles from integrated one, with higher values of redness and yellowness. Differences were significant. Crop nutrition had adverse effect on colour of noodles compared to white flour ones. Noodles from winter wheat grown on non-fertilized plots were darker, with significantly lower lightness, higher value of redness than noodles from fertilized variant. Darker colour of wholegrain noodles is associated with the content of bran fraction and increased extraction rate of flour.

4 Conclusions

Colour of noodles is an important quality factor influencing the decision of a consumer. Farming system, fertilization, flour extraction rate, forecrop and weather conditions during growing period of w. wheat may have significant effect on the colour of wheat noodles. Whole grain noodles from ecological system were darker, with lower lightness, higher redness compared to noodles from integrated system. Farming system did not influence the colour of white flour noodles. Fertilization showed adverse effect on noodle colour values depending on white flour and wholegrain noodles. Fertilization increased redness, yellowness and decrease the lightness of white flour noodles, on the contrary, fertilization increase the lightness and decrease the redness of wholegrain noodles.

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