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ESTIMATION OF TOTAL PHENOLIC CONTENT IN WHEAT GENOTYPES UNDER TERMINAL HEAT STRESS

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ABSTRACT

Phenolic compounds (PC) significantly contribute to wheat's positive health impacts, but their interactions can impact how well wheat-based goods come out. This study aimed to assess the total phenolic content of winter wheat white flour. The experiment was established on a Department of Bioscience and Biotechnology Banasthali Vidyapith, Rajasthan over the years 2022- 2023. Folin-Ciocalteu's method was used to determine the amount of free phenol. The most prevalent type of phenolic chemicals to be found in whole wheat grains are phenolic acids, andthey are one of the largest and most intricate categories of phytochemicals, and they come in a variety of forms, some of which are soluble free compounds, insoluble bound forms and soluble conjugates esterified to sugars and other low molecular mass chemicals. The phenolic content in wheat varieties in late sown ranged from 129- 1038 µg GAEq. /g and in timely sown 80- 1002 µg GAEq. /g respectively. HSI value of ten different genotypes was calculated and genotypes was classified into two different categories i.e., heat tolerant (HSI<1.00) and heat sensitive (HSI>1.00). The overall ranking of heat susceptibility index indicated that out of ten genotypes, six genotypes are heat tolerant and four genotypes are heat sensitive. Thus, the results indicate that polar solvents were important for obtaining high total phenolic content. Also data indicated that the wheat flour was rich in total phenolic content. Therefore, products made from whole wheat optimize health advantages and are highly advised for usage in the food processing industry.

KEYWORDS: Wheat, Phenolic compounds, Phenolic content, Heat susceptibility index (HSI).

INTRODUCTION

The majority of the world's population depends on wheat as their primary source of nutrition, making it one of the most significant cereal crops in the world. Wheat is prone to various environmental stresses. It is grown in a wide range of agro ecologies across the world and experiences various biotic stresses. Plant phenology, growth, and development are negatively impacted by heat stress, whether it occurs alone or in conjunction with other pressures (Wahid, 2007). *Triticum aestivum L*. Sometimes known as wheat grass, is a grass that resembles wheat and is a member of the poaceae family. Almost no human clinical investigations have been conducted to back the claims made about wheatgrass or wheatgrass diet plans (Zendehbad, 2014).The main purpose of wheatgrass is as a concentrated nutrient source. Iron, calcium, magnesium, vitamin A, vitamin C, vitamin E, and amino acids are all present in sufficient amounts (Ben-Arye, 2002).

The secondary metabolites known as phenolic compounds, which are formed throughout plant development and in response to stress circumstances, are efficient oxygen radical scavengers because they have a lower electron reduction potential than oxygen radicals. A good source of plant phenolic is cereal anda significant portion of these molecules may be provided by the main meal of humanity. The most prevalent phenolic compound in cereals, phenolic acids, is found in three different states: soluble free, soluble conjugated, esterified to sugars, and other low molecular weight substances (Brandolini, 2013). Phenolic substances are associated with a reduction in cardiovascular disease, inflammation, and a variety of malignancies thanks to their potent antioxidant properties (Subira, 2021). Researchers have looked at the possibility that these molecules can reduce the harmful reactivity of unwanted reactive oxygen/nitrogen species that are produced as byproducts during bodily metabolic activities. Among the most significant and complex groups of phytochemicals, phenolic acids are the most prevalent form of phenolic compounds found in whole wheat grains. They come in a variety of forms, including soluble free compounds, soluble conjugates that are esterified to sugars and other low molecular mass compounds, and insoluble bound forms (Zilic, 2016).

METHODOLOGY

Plant material

10 wheat genotypes (*Triticum aestivum* L.) viz., GW322, HI617, K0402, K68, Raj 4037, Raj 3765, GW496, Raj 3777, Raj 4238 and K9423 were selected for field experiments for the

support of heat tolerance will be sown at the research plot of KVK for distinct agro climatic conditions admitted the plant material for present study.

Analysis of phenolic content

The total phenol content of the extracted materials was then determined. The Folin-Ciocalteu assay was used to measure the phenolic content (Singleton, 1965). Phenolic chemicals generate a blue complex when they react with phosphomolybdic and phosphotungstic acid at a basic pH. In brief, 0.5 ml of extract was mixed with 0.5 mL of Folin– Ciocalteu reagent and incubated for 5 minutes at room temperature. This was followed by the addition of 0.5 mL sodium carbonate. For roughly two hours; the mixture was incubated at room temperature in the dark.

At 765 nm, absorbance measurements were made after the color blue had been created. Gallic acid served as the standard. In milligrams of Gallic acid equivalents per gram of dried weight (mg GAE/g dried weight), the amount of phenolic content were given. There were three replicas of each experiment (Zendehbad et al., 2014).

Heat susceptibility index (HSI)

The heat susceptibility index (s) was calculated by method as described by Fischer and Maurer (1978) with the following formula:

HSI = [l-YD/YP]/D

Where, YD = mean of the genotypes in stress environment. YP = mean of the genotypes under non-stress environment. D = 1-[mean YD of all genotypes/mean YP of all genotypes].

RESULT

The polarity of the extracting solvents and the solubility of this component in the solvent employed for the extraction process both have an impact on the recovery of phenolic contents in various samples (Safaa et al., 2014).As a result, it can be difficult to determine a suitable solvent for each sample's phenolic content extraction. Using the Folin-Ciocalteu assay, the amount of total phenolics in whole wheat flour extracts was calculated and expressed as Gallic acid equivalents (GAE).

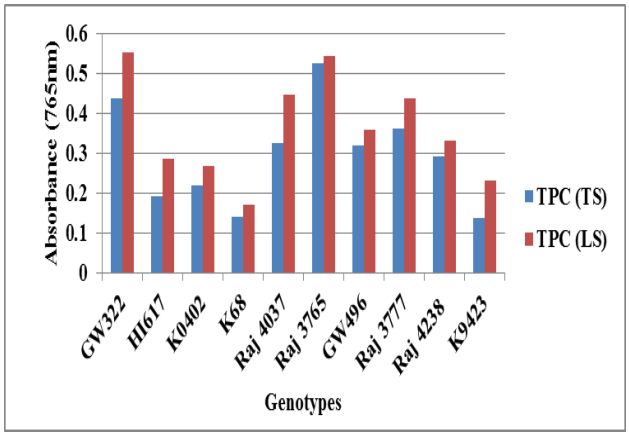

Fig. 1: Graph showed total phenolic content in bread wheat for Timely and Late sown.

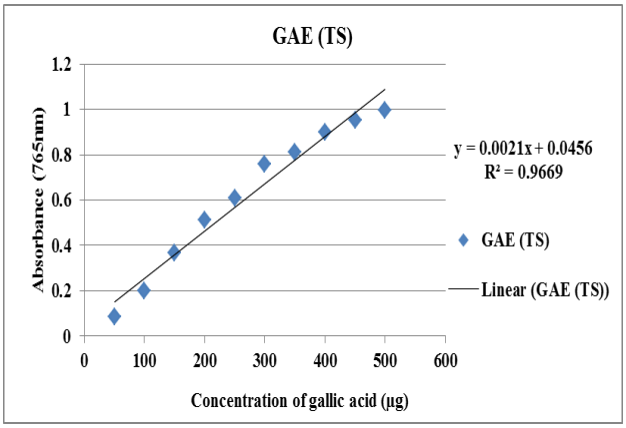

Fig. 2: Standard curve plotted between concentration of Gallic acid (µg) and Absorbance in timely sown.

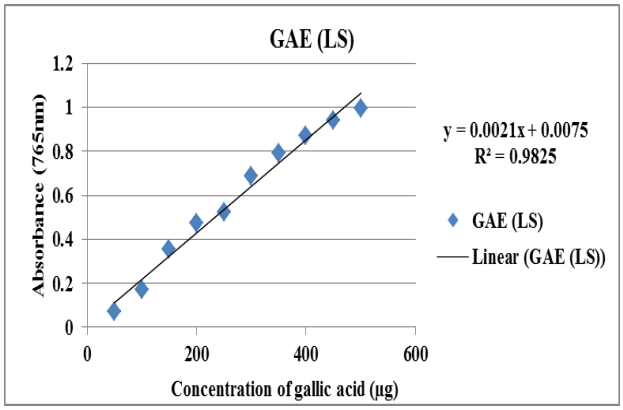

Fig. 3: Standard curve plotted between concentration of Gallic acid (µg) and Absorbance in late sown.

Table 1: Total phenolic content (µgGAEq. /g) in wheat flour.

Sample (Wheat flour)	Calculated values of LS (µg/ g)±S.D	Calculated values of TS (µg/ g)±S.D
GW 322	129±0.015	80±0.047
HI617	244±0.019	176±0.039

K0402	410±0.009	360±0.038
K68	556±0.025	483±0.032
Raj 4037	652±0.068	529±0.040
Raj 3765	802±0.060	698±0.025
GW496	858±0.007	798±0.050
Raj 3777	944±0.073	878±0.039
Raj 4238	998±0.017	949±0.009
K9423	1038±0.023	1002±0.220

The highest total phenolic content was found in late sown as 1038±0.023µg GAEq. /g and lowest in timely sown as 1002±0.220µg GAEq. /g in table 1.

DISCUSSION

The accuracy of analytical data is improved by TPC determination at steady-state. High temperatures and alkaline environments hasten the development and fading of color. According to the current study's findings, the absorbance must first be measured after 30 minutes of incubation. To determine the TPC in the wheat flour, under the specified conditions, a calibration curve was constructed using Gallic acid calibration standards (50 to 500 µg/mL).

In fig.1, total phenolic content in late sown showed higher concentration as compared to timely sown. In fig.1, genotype GW322 showed higher concentration of phenolic content and genotype K68 showed lowest concentration of phenolic contentand in timely sown Raj 3765 showed higher concentration of phenolic content and K9423 showed lowestconcentration of phenolic content. The phenolic content in wheat varieties in late sown ranged from 129-1038µg GAEq. /g and in timely sown 80- 1002 µg GAEq. /g respectively. Overall, the results showed that wheat flour has a high TPC content. TPC levels this high in plants are associated with a variety of pharmacological effects.

In fig.2 and fig.3, absorbance increases as Gallic acid concentration increases in both timely and late sown conditions.In timely sown, coefficient of determination (r^2) of the resulting calibration curve ($y = 0.0021x + 0.0456$) was 0.9669 and in late sown coefficient of determination (R^2) of the resulting calibration curve ($y = 0.0021x + 0.0075$) was 0.9825 indicating excellent linearity in the concentration range under study. The concentrations and absorbance showed a positive correlation. For HSI value of the TPC in different genotypes indicate that six genotypes ie., K0402, K68, Raj 3765, GW496, Raj 4238, Raj3777 are heat

tolerant for TPC traits and four genotypes ie., GW322,HI617, Raj4037, K9423 are heat sensitive for TPC trait.

The solubility of phenolic compounds in the solvent employed for extraction has an impact on phenols from plant materials. Otherwise, enhancing phenolic solubility will mostly depend on the solvent's polarity (Zazouli et al., 2016).

CONCLUSION

While whole-wheat products are not yet widely available, wheat grains are a good source of phenolic chemicals with potential health advantages. The phenolic acids contained in the outer layer of wheat grains are the most prevalent phenolic chemicals. Genotype GW322 in late sown condition showed higher total phenolic content as compared to other genotypes (Fig.1). Those interested in using or developing modern wheat varieties for their health advantages have a basis thanks to the relatively substantial variability among genotypes within species for the total phenolic content (Žilić et al., 2016).The results of this study revealed that the total phenolic content in wheat flour increased significantly. Cereals are a source of phenolic compounds and the beneficial effects on the body will be manifested if flour and whole grain cereal products are consumed.

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Conflict of interest

The corresponding author declares that there are no competing interests on behalf of the other writers.

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