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STUDY ON BEER PRODUCTION FROM SELECTED VARIETIES OF BARLEY

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Abstract: - The production of beer is called brewing. Beer is a fermented beverage made in several steps from cereal grains such as malted barley. Other grains such as corn and rice are being used to aid in the final texture and flavour of the product. The primary ingredients in making beer are: malted barley, water, hops, and yeast. Water generally constitutes more than 90% of the finished product. The final alcohol content may vary from 0.5% to 15% and the pH is typically 4.5 or less. Three variety of barley have been selected in which two are 2-row (DWRB 101 & RD 2849) and one is 6-row (BH 959) barley, were obtained from the Indian Institute of Wheat and Barley Research (IIWBR), Karnal, Haryana. All the parameters and selected variety of barley (BH 959, DWRB 101, & RD 2849) in consideration, during dissertation the superior variety was estimated in descending order (RD 2849, DWRB 101 and BH 959). And during the project work sanitary condition was implemented strictly, Such as in grain receiving, milling, mashing, fermentation, filtration, packaging and pasteurization time. These processing steps directly affected the quality of beer. The final analysis of all three variety of barley was on the basis of alcohol percentage. Highest alcohol percentage was produce from RD 2849 after then DWRB 101 and lowest alcohol percentage was produce from BH 959 variety, 5.90%, 5.20 & and 3.80% respectively.

Key word: - beer, barley variety, processing, & alcohol percentage

1. INTRODUCTION

Beer is the world's most widely consumed and probably the oldest alcoholic beverage, it is the third most popular drink overall, after water and tea. The production of beer is called brewing. Each ingredient has its own function. Barley provides the starch which is converted to maltose and other sugars, and finally to alcohol and carbon dioxide. Colour, flavour and body are other important functions of barley and are dependent on its roasting method. Different degrees of roasting result in a range of coloured beers from very light to very dark. The major steps in producing malt & beer include: barley intake, cleaning & grading, drying, steeping, germination and kilning malt, roasting, milling, mashing, boiling, fermenting, maturing, filtration and packaging or bottling. Barley is one of the founder crops of old world agriculture and is one of the first domesticated cereals. It is fourth largest cereal crop after wheat, rice and maize It is a major source of food for large population of cool and semi-arid areas of the world, where wheat and other cereals are less adapted. In the world barley have the share of 7% of the global cereal production. Malt is the product coming from processed barley that has been steeped in water, germinated on malting floors or in germination boxes or drums, and later dried in kilns, under carefully controlled conditions. Malt is used predominantly as the basic raw material for beer and spirit, with a much smaller quantity used in the food industry. Malt is milled (ground) and mixed with water. During the subsequent procedure, called mashing, high molecular mass components (starch, polymerized carbohydrates) of malt are degraded by enzymes at specific temperatures. The suspension obtained is then filtered to separate the liquid (wort) from the spent grains. This process is called lautering. The wort is subsequently boiled with the addition of hops; the high temperatures cause a coagulation of constituents, which are then called hot trub. They are separated together with the solids from the hops (hot trub removal). The clarified wort is subsequently cooled to the pitching temperature required by the fermentation method and the yeast strain used. The fermentation process is initiated by pitching: this consists of saturating the cold wort with air, and adding cultured yeast. The fermentable low molecular mass components of the wort (glucose, maltose, etc.) are converted to ethanol and numerous aroma compounds according to the metabolism of the yeast. After maturing the taste and enriching with carbon dioxide produced by the fermentation, the beer is filtered to clearness, & bottled. After bottling pasteurization process (heat the beer at 63 ^{0} C and immediately cooled at 5^0 C or below) was completed

2. MATERIAL AND METHOD

The detail of experimental material used and methods applied during the course of present study are described in this chapter under the various headings.

2.1 Raw material

Three variety of barley have been selected in which two are 2-row (DWRB 101 & RD 2849) and one is 6-row (BH 959) barley, were obtained from the Indian Institute of Wheat and Barley Research (IIWBR), Karnal. The grains were partial cleaned to remove impurities.

Table: Selected barley varieties

Variety	Parentage	Salient characteristics	Developed at
DWRB102	DWR28/BH581	Two-row malt barley with good grain under timely sown conditions, resistant to stripe and leaf rusts	DWR Karnal
BH959	BH393/BH331	Six-row feed barley with tolerance to yellow and brown rust	CCSHAU Hisar
RD2849	DWRUB52/PL705	Two-row malt barley with good grain under timely sown conditions, resistant to stripe and leaf rusts	RARI Durgapura

2.2 Malting process

After the completion of physical analysis of grain, the malting process was initiate. The malting process converts raw grain into malt. The malt is mainly used for brewing In this process barley grain which have the starch in polysaccharides form are converted into disaccharide(maltose) sugar form and further many steps are involve. During the dissertation work I taken 100 gm. sample of each variety and then start the malting process at different steps.

2.3 Steeping (10 to 15 hours)

Steeping is the start of the active malting process, steep water is added to cover the grain moisture content increases from around 12% to between 40 & 45% in the first step of Malting process it consists of a 26 hour interrupted steep program (17°C, 8.0 hours submerged, 10 hours air rest with 70% airflow, 8.0 hours submerged).

2.4 Germination (96 hours at 15-18°C)

The aim of germination is to grow the barley grain. These allow to development of malt enzymes, and these enzymes modify the structure of the barley endosperm by breaking down the cell walls and the protein matrix. The enzymes produce during germination are needed to break down the starch for the brewer during the mashing process. Germination is the process in which starch converted into maltose sugar. During germination mostly enzymes are activated, which are favourable for beer production. The grain bed is maintained at a constant temperature of between 15 to 18 ^{0}C for 96 hours.

2.5 Kilning (hot air)

Kilning reduces the grain moisture content and stops the germination process. As the grain dries it is possible to raise the air-on temperature, to further dry the grain, the target malt moisture after kilning is around 5% by weight kilning process consists of a 24 to 26 hours kilning program. The kilning process is complete in 8 cycles, each cycle have 3 hours at different specific temperature. In each cycle temperature increases automatically (the first cycle temperature was 30°C and last cycle temperature is 75°C).

2.6 Deculming
In this process roots & shoot of the malted grains (also known as clums) are removed after kilning.

2.7 Malt cleaning
The malt is cleaned prior to mashing sieves and aspiration to remove the dust, lumps and stone in the malt. Magnets are again used to remove any steel that might damage the mill rollers.

2.8 Milling
The milling of the malted barley is a very important step. Milling is done to better allow the mashing liquor to access the centre of the barley. This allows the enzymes secreted by the aleurone layer to act upon the starchy endosperm. Milling was done with the help of grinder.

2.9 Mashing

Mashing is the process of immersing the milled barley in water. The goal of mashing is to create wort. It is provided an environment in which yeast will thrive. Sugar in the milled barley is in long chains which are unfermentable. The mashing processes allow extracting fermentable sugar form the malt.

2.10 Lautering/filtration
Lautering is a process in brewing, in which the mash is separated into the clear liquid (wort) and the residual grain.

2.11 Wort boiling
Boiling of the wort is the process in which enzymes are inactivate and remains protein is coagulated. And during wort boiling hops are added for bitterness and desired flavour & aroma.

Figure 2.2: prepared wort of selected variety

2.12 Yeast pitches
Yeast is added to the cooled wort as (or after it is added to the fermenter) it is important to get enough healthy yeast in to the brew to achieve a healthy fermentation.

2.13 Fermentation
The term fermentation means the breakdown of carbohydrates materials by micro-organism (or enzymes) under anaerobic conditions. In common usage, the term "fermentation" refers to both the anaerobic and aerobic breakdown of carbohydrates and carbohydrates materials. In brewing fermentation is the process in which sugar are converted into alcohol and carbon dioxide gas with the help of yeast (saccharomyces cerevisiae). Chemical reaction

$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$
(Glucose) = ethyl alcohol + carbon dioxide

2.14 Primary fermentation

Primary fermentation takes place in a bucket or carboy, sometimes left open but stoppered with the carbon dioxide gas produced venting through a fermentation lock, during this time temperature should be kept at optimum temperature for the fermentation process 12-18^0 C. starting within 12 hours & continuing over the next few days, a vigorous fermentation takes place. During this stage the simple sugar maltose in the wort is consumed by the yeast. A sure sign that primary fermentation has finished is that the head of the foam built by bubbling of CO_2 falls.

2.15 Secondary fermentation

During the secondary fermentation remain protein, more complex sugar & impurities are sediment. Secondary fermentation can take from 2 to 4 days, sometimes longer depending on the type of beer.

2.16 Maturation

The maturation process can be described as the period where some of these flavour components are assimilated and converted by the yeast cell. Once the primary fermentation is considered done the final gravity has not been reached yet and fermentation by products like diacetyl and acetaldehyde need to be reduced by the yeast. This process is called maturation of beer. It happens during the long cold storage.

These following process are very important during maturation of the beer:

- **A)** Yeast assimilation
- **B)** Beer volatile washing by CO_2 gas
- **C)** Precipitation of cold break (protein-polyphenol complex)

2.17 Filtration filtering:

The beer stabilizes the flavour, and gives beer its polished shine and brilliance. Not all beer is filtered. Filtration was done with the help of whatman filter paper. The main purpose of filtration is to remove the culture cells within the beer, because if culture cells is migrate in beer then it create oxidation and reduce the quality and shelf life of beer.

2.18 Pasteurization

Pasteurization is the process of gentle heating and rapid cooling of fresh packaged beer to prevent bacterial contamination. The filled and closed packages of beer are conveyed through different sections of a “tunnel” pasteurizer and sprayed with attempted water increasing, holding, and then decreasing the temperature. This first accomplishes pasteurization, and then rapidly recools the beer within minute. The pasteurization time for beer according to industries is 62.8^0 C for 30 minutes.

3. RESULTS AND DISCUSSION

The present investigation entitled “Study on beer production from selected varieties of barley” was carried out. In the present investigation, different quality parameters, composition, processing steps, hygienic & sanitary evaluation were carried out. The results pertaining to different analytical investigations were viewed under scientific relevance and are summarized under following headings

3.1 Alcohol percentage

Alcohol was the final parameter which determines the quality of selected barley variety, because this was the end product of raw materials. Percentage of alcohol was indicate in table

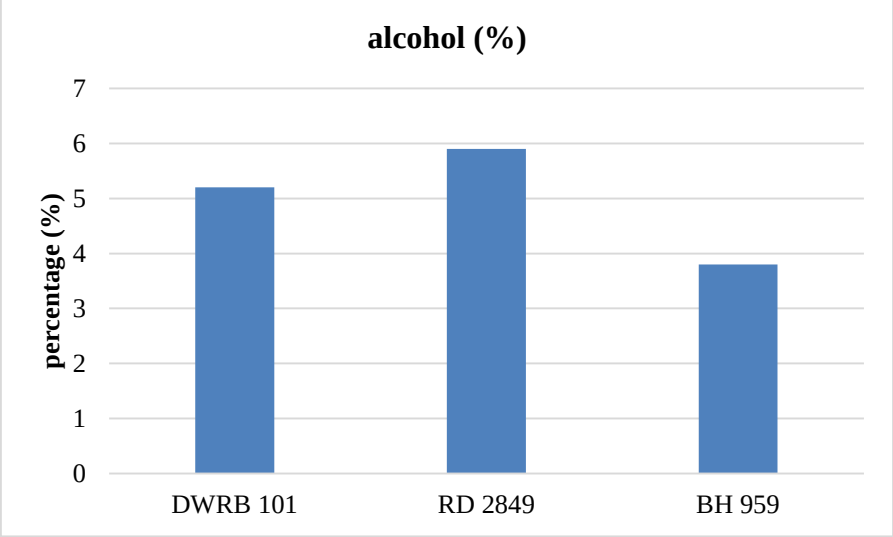

Figure 3.1: Alcohol percentage of selected variety

Table 3.1: Alcohol evaluation from all selected variety

S.No	Name of variety	Alcohol percentage
1	RD 2849	5.90
2	DWRB 101	5.20
3	BH 959	3.80

Taking all the parameters and variety of barley (BH 959, DWRB 101, & RD 2849) in consideration, during dissertation the best variety is in descending order (RD 2849, DWRB 101 and BH 959) was estimated. And during this project sanitary condition was implemented strictly, Such as in grain receiving, milling, mashing, fermentation, filtration, and packaging time. These processing steps directly affected the quality of malt and beer. The final analysis of all three variety of barley was on the basis of alcohol percentage.

4. CONCLUTION

The study concludes that to improvement of quality of malt and beer & safe and wholesome beverage (beer) food products. Taking all the parameters and selected variety of barley (BH 959, DWRB 101, & RD 2849) in consideration, during dissertation the superior variety was estimated in descending order (RD 2849, DWRB 101 and BH 959). And during the project work sanitary condition was implemented strictly, Such as in grain receiving, milling, mashing, fermentation, filtration, packaging and pasteurization time. These processing steps directly affected the quality of beer. The final analysis of all three variety of barley was on the basis of alcohol percentage. Highest alcohol percentage was produce from RD 2849 after then DWRB 101 and lowest alcohol percentage was produce from BH 959 variety, 5.90%, 5.20 & and 3.80% respectively.

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