Different flours in sourdough

Background

Bread has been consumed for thousands of years and is closely related to the cultural evolution of humanity. The oldest known way of fermenting and proving bread is the use of sourdough. Sourdough is a living culture of lactic acid bacteria and yeast fungi, created spontaneously when water is mixed with flour and left for some days in room temperature. The microbes exist both in our surrounding environment and in and inactive shape in the flour, and form a culture that uses the carbohydrates (i.e. starch) of the flour in its metabolism. The products are ethanol and carbon dioxide from the yeast and acids, mainly lactic acid, from the LAB (lactic acid bacteria).

Sourdough in a glass jar

Sourdough is added to bread dough, transferring the microbiological culture to it. The carbon dioxide from the yeast creates air bubbles in the bread, held on place by the protein gluten that will make the dough elastic. The acids give the bread a characteristic smell and taste. The acids will also lower the GI value, make the bread more resistant to mold, prolong the shelf-life and set minerals from the flour free for the digestive system to consume.

The microbes in the flour come mostly from insects and warm-blooded organisms through contaminations both during farming and milling. In a sourdough, a selection of the best microbes has been made, as the others will not survive the acetic environment. In order to keep the culture alive, a sourdough has to be regularly backslopped, which means that it is mixed with more water and flour. The concentration of microbes will be much higher in the dough than in the added flour. Thus, an increase in ability of gas production will only take place if the added flour contains microbes with a very high competitive ability, that can increase the metabolic capacity of the microbiological culture.

The chemical properties of the flour do also matter for metabolic capacity. A flour with many micronutrients and amino acids will provide a better capacity. So will also a flour with a high buffer capacity, as the acids are harmful for the microbes.

Question and purpose

In conversations with bakers and in recipes, I have met the opinion that for a sourdough, organic and fresh flour, will give the best proving. An un-organic flour is said to be practically sterile, and the so is also the case with old flour. The aim has been to investigate if the type of flour has impact on gas production in the dough. Therefore, gas production over time has been measured for sourdough mixed with several different types of flour. So-called "special flour", gluten-rich flour that will form more elastic doughs, has also been measured. The flours *Aros* and *Algot* from the bakery *Lokal* in Kumla, has been measured as well. These are "cultural grains", older types of grains farmed in an organic and old-fashioned way. Aros is also a full-grain flour. Such flour will normally contain more microbes as those mainly live on the outside of the kernel. A flour with a higher capacity of gas production will, with the right baking technique, produce a fluffier and lighter bread, which is the ideal for the normal consumer.

Sourdough bread

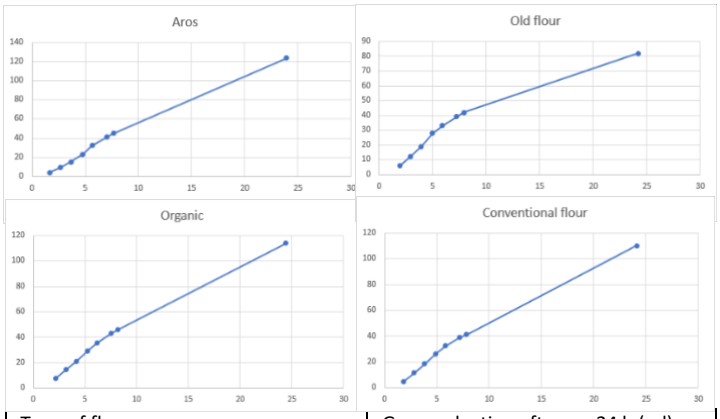
All the investigated flours (all of wheat) are: conventional flour, organic flour, "special flour", old (ca. 10 y.) flour, old "special flour", *Algot*, *Aros*.

Method

The gas production over time has been measured as it gives an indication of how the gas production develops. It has been measured regularly for 8 hours and one time after ca. 24 hours, when the metabolism and gas production have decreased and practically stopped. This has been done by mixing a sourdough by existent sourdough, water and the investigated flour in a closed glass tube, and leading all the produced gas to an eudiometer, which is a water-filled glass tube that shows the volume of the gas. Bacteria have also been grown on agar plates from all the different investigated types of flour.

Results

The conventional flour was almost sterile, but produced almost as much gas as the organic. Both the old flours showed themselves to be sterile and had also the smallest production. The "special flour" created less gas than the conventional equivalent. *Aros* and *Algot* had a rich growth of bacteria with remarkably different smell and appearance. *Algot* created a little bit more gas than "special flour" and remarkably less than conventional or organic. *Aros* created the highest amount of gas, even though that production was low the first hours. The graph shows the production of four of the flour types (in order to provide an example), measured in ml over time (h).



Type of flour	Gas production after ca. 24 h (ml)
Organic	113,9
Conventional	110.3
Gluten-rich	94
Old	82
Old and gluten-rich	59
Aros	123,9
Algot	98,5

Discussion

The whole-grain flour showed itself, not so surprisingly, to have the highest gas production. The high amount of fibers and minerals will make this bread the healthiest. Though, there could be differences in taste compared to other bread, that also could be an important factor.

Organic flour did not show itself to be much better than the conventional one. The number of bacteria was higher though, which might be because the conventional plants during growth has less contacts with insects, that will bring a major part of the sourdough microbes. It is likely that over time, highly competitional species will arrive from the organic flour and make the culture metabolically stronger. Of that reason, the organic flour will be better to use. It is also better for the climate and the environment.

Gluten-rich flour does necessary not have to be better in use. Even if it could create a stretchy dough, it maybe cannot create as much gas. The lower production might be because the strong gluten-structure creates a higher resistance and lessens the ability of releasing gas in the dough.

Old flour showed itself to be sterile and we can see that it should probably not be used. It is hard to know if the low gas production depends on the sterility or a degradation of chemical properties. The chemical features of the flour have probably an important impact on the results in this experiment. This could be the subject of future research and experimenting.