Agro-processing of maize

Most value-added food products available to consumers have been processed in one way or another. Without the aid of food processing, we would not have the convenience of the large variety of food products available to us.

The processing options available to maize growers are numerous and varied:

**Alcohol from maize:** Maize provides the industry with a readily available, dependable and economic source of carbohydrates. By applying biotechnology, the carbohydrates can be converted into useful products such as alcohol, organic acids, amino acids, antibiotics, enzymes, pigments, polysaccharides and vitamins. Alcohol is produced through a yeast fermentation process. Starch is first converted to sugars and the sugars are then converted to ethanol and carbon dioxide in the presence of water by the action of specific yeast cultures.

**Baked, extruded maize snacks:** Maize is the cereal base most commonly used by South African snack manufacturers and our milling industry is geared for producing high quality maize grits. Maize snacks fall into three categories: Extrusion-puffed snacks from maize meal/grits; baked or fried snacks from 'masa'; and puffed maize snacks. Baked, extruded maize snacks are essentially the same as their fried counterparts, but have a much lower kJ content since they are dehydrated by baking instead of frying.

**Flaked maize cereal,** better known as corn flakes, is a ready-to-eat breakfast cereal that only requires the addition of milk. The basic objective in making flaked cereals is to obtain grain grits from the whole grain that would each produce a flake.

**Fried, extruded maize snacks** are manufactured through extruding moistened maize meal under high pressure and temperature conditions. The puffed product is then fried and usually coated with a savoury flavour such as cheese, chilli, barbeque sauce, sour cream or onion. The flavouring agent is applied in a powder form.

**Mageu** is a traditional sour maize beverage. It contains little or no alcohol, but has a pH of approximately 3.5. It is especially popular during the hot summer months due to its refreshing sour taste and thirst-quenching properties. Fresh mageu has a limited shelf life and must therefore be pasteurised for retail distribution. Various flavours of packaged mageu are available on the market. While the plain product remains the most popular, banana, cream, pineapple, strawberry and guava flavours are also enjoyed. Industrial preparation of mageu involves the use of refined ingredients such as maize meal, wheat flour, sugar and starter cultures, and a standardised well-controlled process.

**Maize chips and snacks** are manufactured using an extrusion-based process similar to that of puffed maize snacks. They are cooked at relatively low temperatures and then sheeted out, cut into shapes (which may or may not resemble potato chips) and fried to remove moisture and complete the cooking process. Maize chips essentially undergo no expansion or puffing when leaving the extruder. Maize chips were originally developed and produced as an imitation of the very popular potato chip (crisp). These products have since become increasingly popular and occupy an important section of the snack market.
**Mealie meal** is the staple food of a large proportion of the South African population. It is mainly used for the preparation of traditional thick or thin porridge.

**Masa flour** is produced by drying and grinding lime-cooked maize kernels.

**Puffed maize cereal** is an extruded, ready-to-eat breakfast cereal that only requires the addition of milk for consumption. It is manufactured from maize meal, salt, sugar, syrups, flavouring, shortening, water and various coatings. It comes in a variety of shapes, sizes and flavours. The cereal is produced by the application of heat to cook the dough and produce rapid vaporisation of the water, then a sudden decrease in pressure with ejection from the extrusion barrel. Puffing takes place in a puffing gun.

**Puffed maize snacks** are cooked and shaped by an extruder, but puffed by a separate process step such as frying or hot air puffing. The extruded product is partially dried prior to puffing and can be held in this form for long periods for easy distribution or storage, and later puffed in the same plant or by decentralised, smaller food processors. It can also be sold directly to the consumer to be fried at home, in restaurants, etc. for immediate consumption.

**Maize oil**: Maize is considered as an important source of edible oil, considering the significant maize production and the large proportion of germ in the kernel (11.5-24.7% by weight) containing 34-52% oil. The oil is extracted by physical separation of the germ from the kernel, and then chemically by means of solvent extraction. The oil is refined by various treatments to produce edible oil of high quality that can be used for frying and baking.

**Maize starch**: The starch fraction of the maize kernel is extracted through wet milling, sieving, washing and centrifugation. The final starch slurry that is free of the fibre and protein fractions is dried and packaged in powder form. Dry native starch and all its modified forms have endless applications in processed food products as well as various industrial sectors.

**Maize syrups or glucose sweeteners** are manufactured from the starchy endosperm of maize by using a conversion process known as hydrolysis. The hydrolysis process can be chemical (by means of strong acids) or enzymatic or a combination of the two. Various types of maize syrups can be produced, depending on the processing conditions and hydrolysis agents used.

**Popcorn** is a summer crop that is harvested in autumn and is planted in the same way as field corn/maize. Popcorn kernels range in colour from off-white, light golden, red, black and many colours in between. The specific variety planted should suit the area, climate and intended processing options. It is a known fact that the hybrid variety used has a big influence on the popability of the popcorn, for both conventional and microwave popping. Popcorn has recently been popularised as a nutritious snack if it is prepared without the use of oil, butter or salt.

Tortillas are flat, circular, light coloured unleavened bread, roughly 1-3mm thick and 15-30cm in diameter. Tortillas are the base for burritos, tacos and a multitude of other dishes. They make superb alternatives to wheat products such as bread, pitas, muffins and crackers, because they are gluten free. They can be wrapped around fillings, used as tasty food scoops, toasted and topped with salad or served hot and plain.

Tacos are tortillas that were allowed to undergo starch degradation and then formed into a 'U' shape and fried. It is a crisp tortilla filled with seasoned beef, lettuce and cheddar cheese.

The manual on the Agro-processing of Cereal Crops, Vol 1 contains complete information on the products discussed above as well as many other processing methods and products. The manual is available from the ARC - Institute for Agricultural Engineering. Contact Elmarie Stoltz on 012 842 4017 or email stoltze@arc.agric.za.