

### **Popcorn Expansion: How Big and How Much?**

Expansion is the amount of growth in volume that the corn goes through in the popping process. In general the more the corn expands the better the product. High expansion corn is desirable for both the consumer and the manufacturer. From a consumer's point of view high expansion corn is more tender and has fewer partially popped kernels that are hard to chew. From a commercial standpoint the expansion can have a direct affect on the profitability of the operation. In concession stands at sporting events and in movie theaters, the concession operator buys popcorn by weight and sells it by volume (full box or bag). High expansion translates directly to increased profitability. Each percentage point of increased expansion is a reduction in raw material cost.

In snack food plants where the end product is packaged and sold by weight the financial reason to favor high expansion is not as pronounced, however it does exist. The customer usually equates high expansion corn with high quality. For the manufacturer high expansion will create a physically larger bag for the same weight and may be considered a better value by the customer. High expansion corn also usually indicates a low percentage of unpopped kernels or scrap. In this case corn is not only purchased by weight but it is also sold by weight. Lower scrap reduces raw material costs. If the expansion of the corn supplied to a snack food manufacturer is not consistent it creates two problems. The first is that when customers do not find a consistent product they do not search for a particular brand. The second is that when the expansion is low, a preprinted bag filled to the correct weight will not appear full to the consumer.

To measure popcorn expansion, commercial corn processors and large popcorn consumers use the Metric Weight Volume Tester to determine the potential expansion of a batch of popcorn. The MWVT is the official measuring instrument of the Popcorn Institute, an organization that represents many of the popcorn processors in the United States. (The MWVT is manufactured by C. Cretors & Co. of Chicago Illinois) The MWVT was originally developed for the popcorn processors own use in their corn processing plants. Before hybrid grains became common, moisture and growing conditions were the primary factors affecting the expansion of the popcorn. The popcorn processor would take a small sample from a large bin of freshly harvested corn and test it with the MWVT and record the result. The processor would then begin to dry small samples of the corn, testing the expansion as the process continued. As the corn was dried from normal harvesting moisture the expansion would increase. When the tests indicated the expansion was beginning to decrease the processor knew at what moisture content the whole batch of corn should be dried to in order to get the maximum expansion from the corn.

The MWVT consists of a batch type oil popper with a calibrated cylinder into which the popped corn falls. This cylinder is calibrated to define the expansion of the corn in cubic centimeters of popped corn per gram of raw popcorn input.

The MWVT is equipped with instrumentation that permits accurate means of measuring the temperature and energy consumption of the popper and the expansion of the popped corn. This instrumentation makes it possible to duplicate results from one machine to another and provides a means of comparing different batches and hybrids of corn.

The measuring tube of the MWVT is 4 ½ inches (11.4 CM) in diameter and 40 inches (101 CM) long. This provides good resolution and sensitivity for the laboratory. In the typical snack food plant a quick method for determining the effectiveness of the adjustments made to the popcorn machine and the efficiency of operation is needed.

The MWVT is used primarily as a guide to the future performance of popcorn when it is popped. Once corn is popped another method of measurement is needed. The most useful is bulk density. While the MWVT defined to volume of popcorn produced as a function of the amount of raw corn that was popped the bulk density of the final product gives an indication of the effectiveness of the popping process itself. When actually operating a continuous automatic popcorn machine, the bulk density of the popcorn can be measured with a large open box. The corn that is to be measured should be taken from the system after the sifter and before the coating or flavoring is applied. In the case of oil popped corn this not possible.

The box should be approximately 12 Inches (0.3M) on a side for a total volume of 1 Cubic foot (.027M<sup>3</sup>). The normal weight range of the corn needed to fill the box will be from 1.32 to 1.60 Pounds (600 to 725 grams) for flake corn used to make salted and savory products 1.32 to 1.6 pounds / cubic foot (21 - 25 Gr./L). When making caramel corn, the weight will be higher and the density can be from 1.75 to 2.00 pounds per cubic foot (800 to 900) grams (28 - 32 Gr./L). The large box is necessary, popped popcorn kernels are very irregular and tend to "bridge" when placed in a small container. The bridging affect will make consistent results dependent on the skill of the technician doing the measurement. The large container eliminates much of the problem of bridging.

In addition to moisture content, corn hybrid and physical condition also affect the expansion of popcorn. Cracks and abrasion on the outside of the kernels will reduce popping expansion.