DO WE HAVE A GOOD INSECT-RESISTANT DRIED FRUIT PACKAGE?

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On various occasions since I began my work at Fresno, I have heard requests for research to develop insect-resistant packages. This usually occurs immediately after some processor has had a large number of infested packages returned to him. We were wondering if it was necessary to have any infested packages returned. Considerable research had been done, and a great deal accomplished in developing moisture barrier and vapor barrier packages for dried fruits and tree nuts. Wasn't it time that we became more active in the development of more insect-resistant packages? We thought that it was time, so in 1965 we began our preliminary studies. I would like to discuss the results of this work and our future plans with you today.

From the very start, our work has been divided into 2 sections. One part consists of a survey and testing of packages presently in use, and the other is development of new packaging. The original intentions of the survey segment of the project consisted of interviewing all packers of dried fruits and tree nuts to determine the type packages now being used. To date, we have interviewed 13 packers, mostly from the raisin industry, but some are from the prune industry, and other dried fruit packers. Although this is only a small portion of the packers, the packages that these people are using are all very similar, and we doubt that our continuing survey of the industry will reveal any particularly different type of package being used.

The testing program was also started in 1965. An exposure room was built. This is a 12 ft. by 12 ft. room kept at a constant temperature of 80° F. and a relative humidity of 40-50%. We have released in this room large numbers of insects that attack dried fruits. Most of the insects are of the invader type, meaning they do little chewing to get into a package. They prefer to enter through the seal or other small openings. Other researchers have stated that more than 75% of infestations in packages are a result of insect invasion. Insects of this type in the room include Indian-meal moth, saw-toothed, and merchant grain beetles, red flour beetle, and confused flour beetle. We also have added 2 species of dermestid beetles, which are called penetrators and are capable of chewing into many type packages. Our future plans call for adding another room, and then we will separate the penetrators from the invaders.

At the present time, we have tested or are in the process of testing some 941 packages. These include 18 series of cartons and 17 series of visi-packs or pouches. These packages are filled with raisins, figs, prunes, peaches, apricots, or mixed dried fruits. From these tests we have obtained some interesting results. It must be remembered that these packages were exposed to extreme heavy infestations, but the results still give us a good comparison.

We divided all of the cartons tested into 4 basic types and put them together regardless of their contents or type of inner liner. The first type included those with no overwrap, and 100% of these were infested at the end of one month. Furthermore, none of these infestations were from penetration but all from invasion through seals. The second type of cartons tested were those with a wax paper overwrap. These did not fare much better since 85% were infested when examined at the end of one month. The third type, or those with cellophane overwraps, were 73% infested within the same time limit. In these tests, it was found that some of the insects, considered invaders for most packages, could easily chew through cellophane. The last type included cartons with foil overwrap. Only 54% of these were infested at the end of 1 month. The degree of protection here was in direct proportion to how well the foil was sealed. However, at 3 months 72% of these packages were infested and much of this increase was due to holes chewed through the foil.

Most of the tests with the visi-pack or pouches are still continuing although we do have results of the 1 month examination. We have exposed 5 types of cellophane-saran packages including K202 and K203, and all were infested at the end of 1 month. The pouches made of polyethylene and cellophane were much better, since only 25% were infested at the 1-month examination, and 33% at 3 months. All thicknesses of polyethylene up through 2 mils were included. Pouches made of other combinations including polypropylenes and poly-cello-saran also had some infestations at 1 month, but only 27% at 3 months. Most of the infestations in the visi-packs were the result of actual penetration.

Some work also has been accomplished on the developmental phase of our program. Since, as we stated previously, a large amount of infestation in cartons is a result of poor sealing, we have been cooperating with the Fibreboard Corporation in the development of better sealing compounds. They have developed a compound, which we are testing at the present time, that looks very good.

Another phase of our developmental program is to test new films or new combinations of existing films. Films laminated to bleached kraft board are tested in a plastic cell developed by Fibreboard. By the use of this cell, it is possible to determine if the insects can penetrate the film without the advantages of a crease, flaw, or corner. Work done to date indicates the insects have difficulty penetrating even plain kraft board unless they can have a "foothold". In fact, it was necessary to place the cells with the film surface face downward nearly touching the floor before the insects could penetrate them. Unfortunately, it is impossible to place a package on a shelf without providing some leverage for the insect, therefore we should not give them the added advantage of faulty construction, improper sealing, or breaks or holes in the protective surfaces. It is hoped that with the multitude of new films and combinations that are available, there will be one that will give the additional insect protection that is so badly needed, along with all of the other desirable features necessary to produce a good package for your industry. It is for this purpose that this project was established, and we hope that it will be successful.

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