MOISTURE METHOD AND STABILITY STUDIES

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The stability, texture, and appearance of dried fruits are closely associated with their moisture content. Frequent moisture measurements are made during the course of production to insure an efficient operation and a product of optimum quality. Because of the high sugar content of dried fruit, most of the moisture methods available are not applicable.

Vacuum Oven.

A study was made to determine whether any sugar decomposition occurred during vacuum oven drying, which is the standard or reference method for dried fruits. The samples were analyzed for total sugar before and after drying in the vacuum oven for 30 hrs. at 60°C. There was a definite sugar loss in the heated sample, and the loss was greater in the fruits with higher acid content (Table 1). The sugar decomposition products were not identified. However, a decrease in sugar content does not necessarily mean a corresponding loss in sample weight. Despite this possible source of error, the vacuum-oven method can be relied upon to give reproducible results if a detailed procedure is followed.

Electrical Conductance.

The effect variation in fruit composition had on moisture, as determined by the Dried Fruit Moisture Tester, was investigated. Various amounts of sugars, oil, acids, and salts, (NaCl) were added to the ground fruit. None of the additives caused any significant effect except sodium chloride. As the salt content increased so did conductance, and the increase was greater, for a given salt level, in the higher-moisture fruits (Table 2). Most dried fruits contain from 0.5 - 1.5% potassium. It is therefore conceivable that variations could occur

in the fruit compositions that would effect the conductance moisture readings. Even though this possibility of error exists, this method serves a definite need in that it is rapid and simple to run.

Dielectric Properties.

Water has a high dielectric constant, therefore, any change in the amount of water in a material results in a corresponding change in its dielectric properties. This principle is used in a number of instruments for moisture determination. This study was conducted using a Moisture Register, Model G-6*.

Approximately 50 g of ground fruit was placed in a cylinder positioned over the electrodes, which were concentric rings. A hydraulic plunger pressed the sample down on the ring electrodes until a constant pressure (1,000 lb. dial reading) was obtained. Using the same pressure for each determination provided samples of relatively uniform density. Dial readings were referred to a calibration curve (Fig. 1) prepared for each fruit by the vacuum oven method. Each resistance range box of the Moisture Register must be calibrated individually for maximum accuracy, which might be a disadvantage. Also, variability in readings may result from variation in sample density in the cylinder due to entrapped air pockets in the ground fruit or variation in the sample temperature. This method provides a relatively rapid means for moisture estimation in dried fruits.

Refractive Index.

A direct linear relationship was found between the moisture of dried fruits, determined by the vacuum oven, and their refractive index (Fig. 2). In this procedure, a small amount (about 50 mg) of ground, well-mixed fruit (prunes pitted) was placed directly on the prism of a refractometer, and the refractive index determined at 25°C. Triplicate readings were taken per sample. This method had good precision and was both rapid and simple.

*Manufactured by the Moisture Register Company, Alhambra, California.

Storage Stability Study.

In relation to storage stability, a flavor comparison was made to determine the effect moisture level had on the storage qualities of prunes and raisins. In high moisture fruit, there was a noticeable difference in flavor in a few weeks between samples kept at zero degrees and those stored at 90°F. Conversely, low moisture fruits remained in 90° storage for approximately twice as long as the higher moisture ones, before a difference in flavor could be detected. This indicates that, in the presence of atmosphere oxygen, dried fruits will have a longer storage life if they are kept at a lower moisture level.

In review, some possible sources of errors are mentioned in relationship to determining moisture with the vacuum oven and Dried Fruit Moisture Tester. Also, a couple of new moisture methods are discussed, based on change in dielectric and refractive index. In addition, a brief report is given indicating that lower moisture dried fruits have a longer storage life than higher moisture ones.

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Table 1.

Sugar loss, expressed on moisture-free basis, from dried fruit during 30 hr. in vacuum oven at 60°C.

Dried fruit	Sugar loss	Acid content, calculated as malic
Figs	0.6 %	0.54 %
Prunes	3.4	1.15
Raisins	4.7	1.57
Apples	6.0	1.63
Apricots	6.6	4.38

Table 2.

Effect of salt on conductance moisture measurement.

Fruit	Added NaCl	Moisture readings by D.F.A. meter	Difference
Raisins	0 %	16.7 %	base
	0.5	17.2	0.5
	1.0	17.7	1.0
	1.5	18.0	1.3
	2.0	18.6	1.9
Prunes	0	30.5	base
	0.5	34.5	4.0
	1.0	37.6	7.1
	1.5	40.0	9.5
	2.0	41.3	10.8

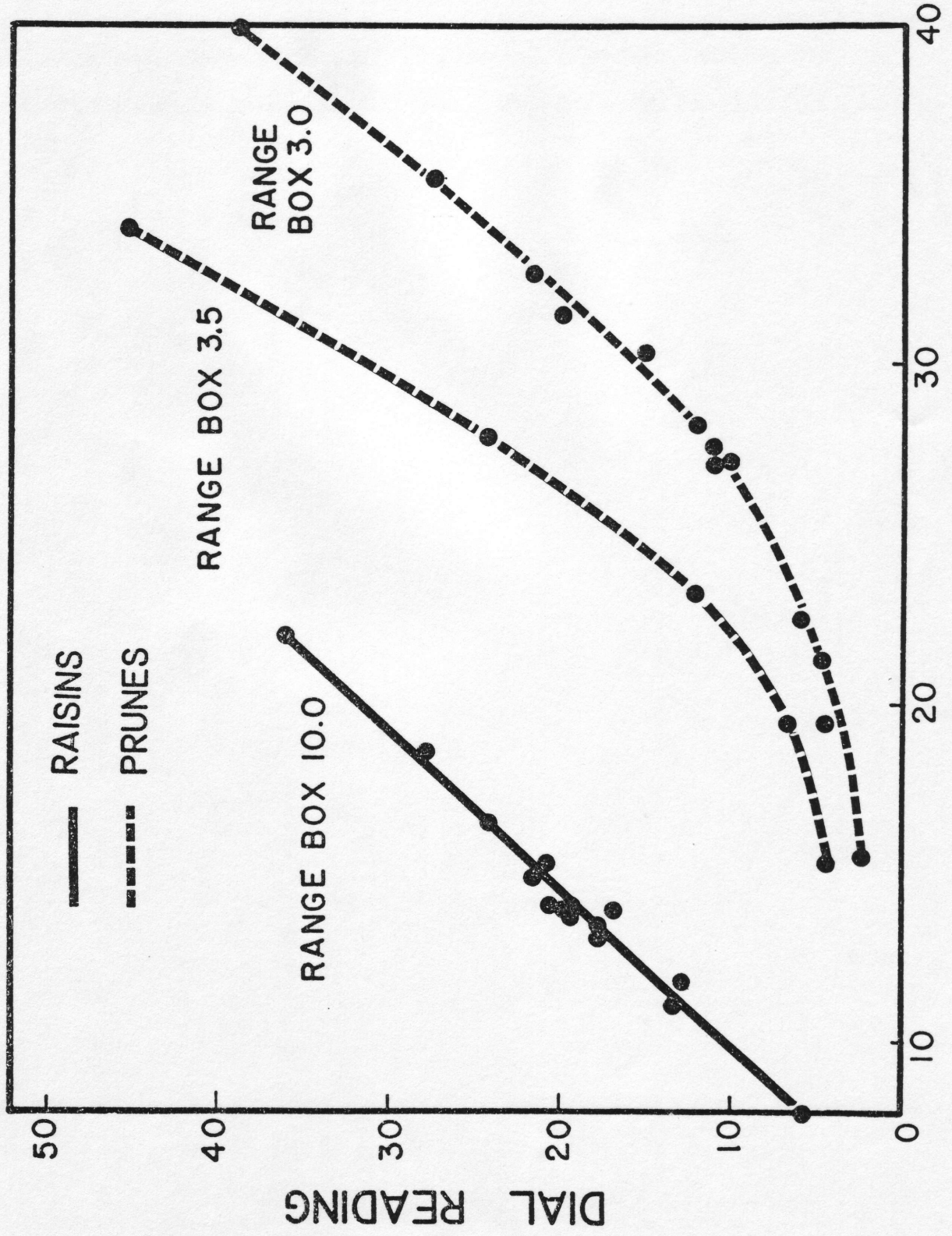
RAISINS
PRUNES
RANGE BOX 10.0
RANGE BOX 3.5
RANGE BOX 3.0
DIAL READING
MOISTURE – PERCENT
0
10
20
30
40
50
10
20
30
40

FIG. 1

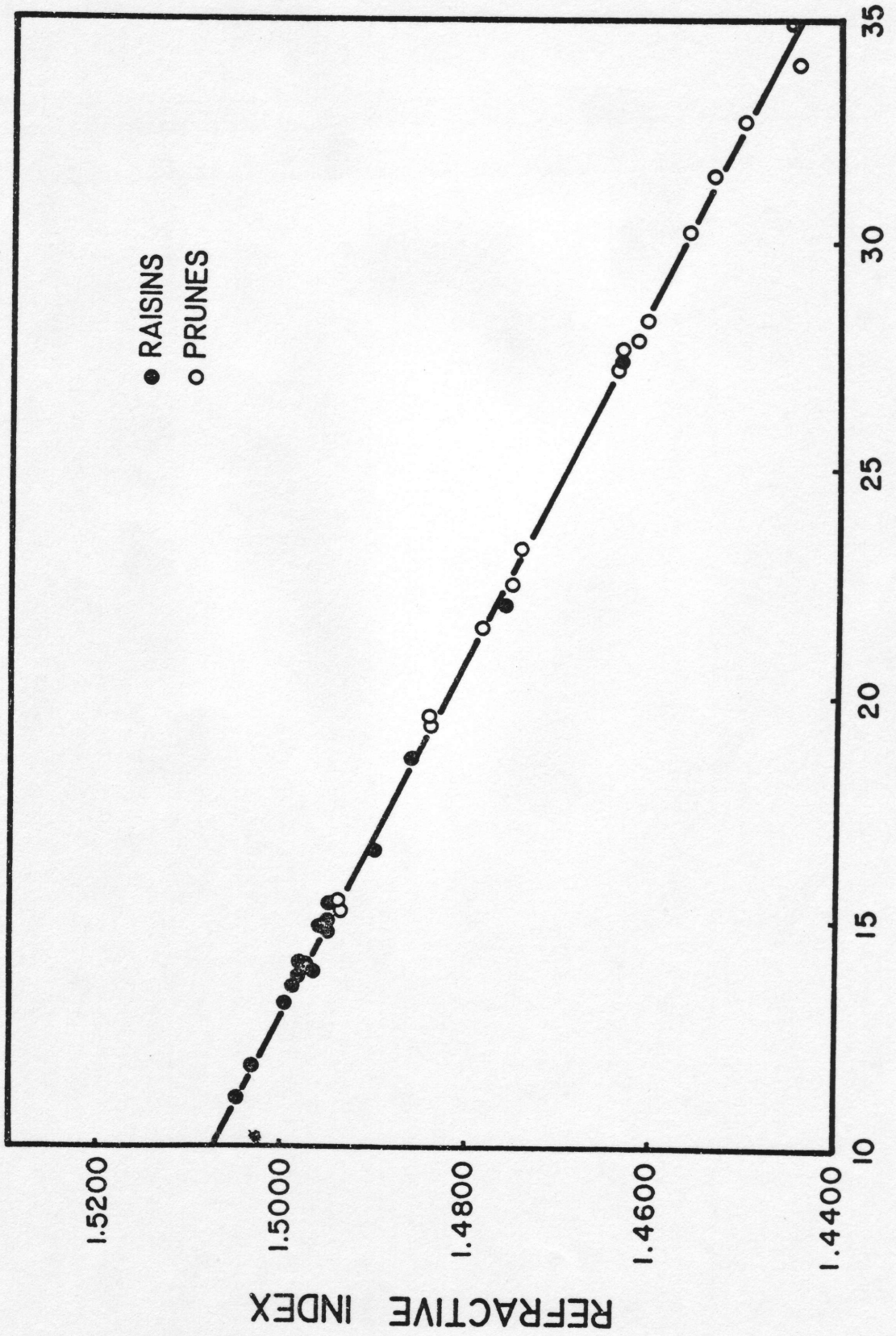
● RAISINS
o PRUNES
1.5200
1.5000
1.4800
1.4600
1.4400
REFRACTIVE INDEX
10
15
20
25
30
35
MOISTURE – PERCENT

FIG. 2