LOSS OF SULFUR DIOXIDE FROM PROCESSED DRIED FRUITS IN RETAIL PACKAGES

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In production of light-colored dried fruits (i.e., cut fruits, golden raisins) sulfur dioxide is used universally. This chemical acts as a bleaching agent, color stabilizing agent, insecticide and as microbial inhibitor (1, 3) in dried fruits. It is therefore an important chemical on which the production of a substantial quantity of dried fruits depends. The exposure of cut fruits (apricots, peaches, pears and apples) as well as grapes to fumes of burning sulfur before the fruit is dried has been practiced for a long time. In this procedure, the fruit is exposed to burning fumes of sulfur for a required length of time, which for most fruits may vary from 3-12 hours. The fruit is then sun-dried or dehydrated and stored for processing. Sometimes the dried fruits so obtained are sulfured again prior to processing. Stadtman et al. (4, 5) have shown in detail the influence of temperature, moisture and SO_2 level on deterioration of apricots, but to date no published information is available on the fate of SO_2 in processed dried fruits in commercial retail packages. This information is of value to the processors and handlers of dried fruits. It is of particular importance to the export trade because of recent limitations set on sulfur dioxide content by some importing countries.

This paper reports on the rate of SO_2 loss from processed golden bleached raisins and dried apricots in retail packages, which were exposed to different time-temperature experiences.

Material and Methods

The apricots and golden bleached raisins used in this study were obtained from a commercial packing house. They represent typical retail packages which were processed and packed by the normal procedures of cleaning, partial hydration, sulfuring, and sorting of the dried fruits.

Two hundred and sixteen 12-ounce packages each of golden bleached raisins and apricots which were packed in transparant saran-treated cellophane (K202) bags were stored at 50°, 70° and 90° F. all at 60% relative humidity for observation. Analyses of composite samples were made initially (see Table I) in accordance with established procedures of the Association of Official Agricultural Chemists.

Sulfur dioxide analyses were made periodically by the method of Nury et al. (2).

Results and Discussion

The sulfur dioxide content of apricots and golden bleached raisins at different temperatures are plotted in Figs. 1-6. The regression of SO_2 content on time is also shown for each dried fruit at each temperature. The rate of loss of SO_2 per day of storage at various temperatures can be seen in Table 2. The latter rate was calculated on the basis of the slope of the curves.

As can be seen, the rate of SO_2 loss in apricots is more rapid than that in golden bleached raisins. This may be due to higher initial SO_2 content in the apricots. However, differences in total sugar and in reducing sugar content and particularly in moisture content of the product are also contributing factors to the more rapid rate of SO_2 loss in apricots.

At 90° F., the rate of SO_2 loss was about 2.7 and 8 times faster than that in the same fruit stored at 70° and 50° F., respectively. For golden bleached raisins, the rate of loss of SO_2 was nearly 2.7 and 5.1 times faster at 90° than that at 70° and 50° F. The calculated rate of SO_2 loss per day in retail packages of golden bleached raisins and apricots stored at various temperatures may be used to estimate SO_2 levels after certain time-temperature experiences either in transit or in warehouse storage. It was found that when SO_2 content is at levels of about 1000 p.p.m. or less in apricots and 600 p.p.m. or less in golden bleached raisins, the fruit color is inferior and its acceptability doubtful.

Reference List

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3. Schwarz, T.A. Unpublished data. Sunsweet Growers Inc. 1958.

4. Stadtman, E.R., Barker, H.A., Haas, V., and Mrak, E.M. 1946. Influence of Temperature on Deterioration of Apricots. Indus. and Engin. Chem. 38(5): 541-43.

5. Stadtman, E.R., Barker, H.A., Mrak, E.M. and Mackinney, G. 1946. Storage of Dried Fruits. Influence of Moisture and SO_2 on Deterioration of Apricots. Indus. and Engin. Chem. 38(3): 99-105.

Table I ANALYSES OF DRIED FRUITS USED IN THE STUDY

	Apricots	Golden Raisins
Moisture	32.5	16.05
Crude Fiber	2.80	0.82
Nitrogen Percent	0.57	0.46
Ash Percent	2.75	1.77
Sugar Content Total	44.2	71.2
Reducing	21.8	70.7
Fructose	9.9	40.0
Glucose	11.9	30.7
Sucrose	22.4	.5
SO_2 p.p.m. ("as is" basis)	2700	.450

Table II RATE OF SO_2 LOSS PER DAY IN PROCESSED GOLDEN BLEACHED RAISINS AND APRICOTS AT VARIOUS TEMPERATURES

P.P.M. SO_2 (loss) Per Day

Temp.	Days in Storage	Apricots	Golden Raisins
90° F.	0-167	21.9	8.6
70° F.	0-449	7.9	3.2
50° F.	0-463	2.6	1.6

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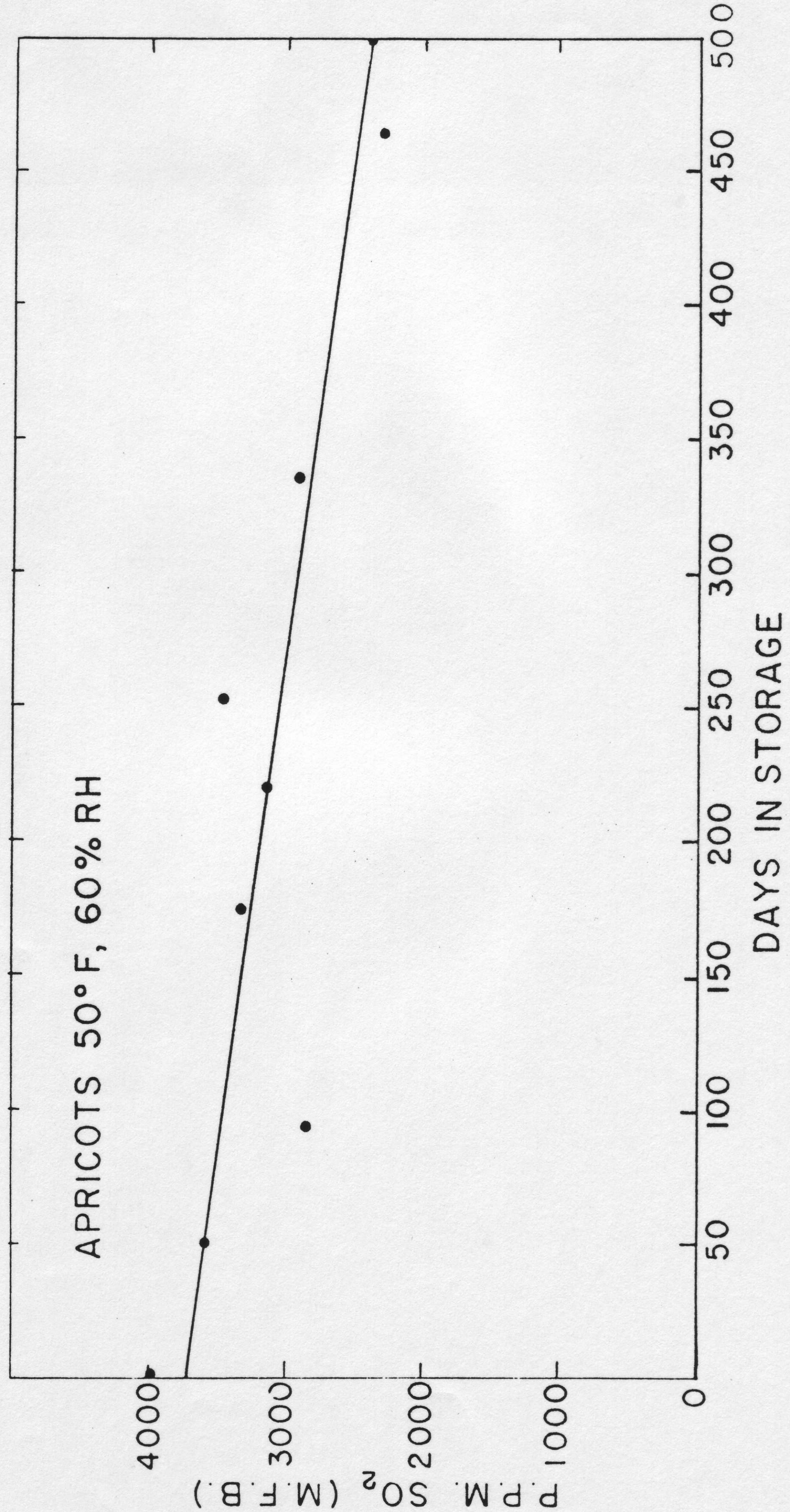
APRICOTS 50° F, 60% RH
P.P.M. SO2 (M.F.B.)
4000
3000
2000
1000
0
50
100
150
200
250
300
350
400
450
500
DAYS IN STORAGE

Fig. 1

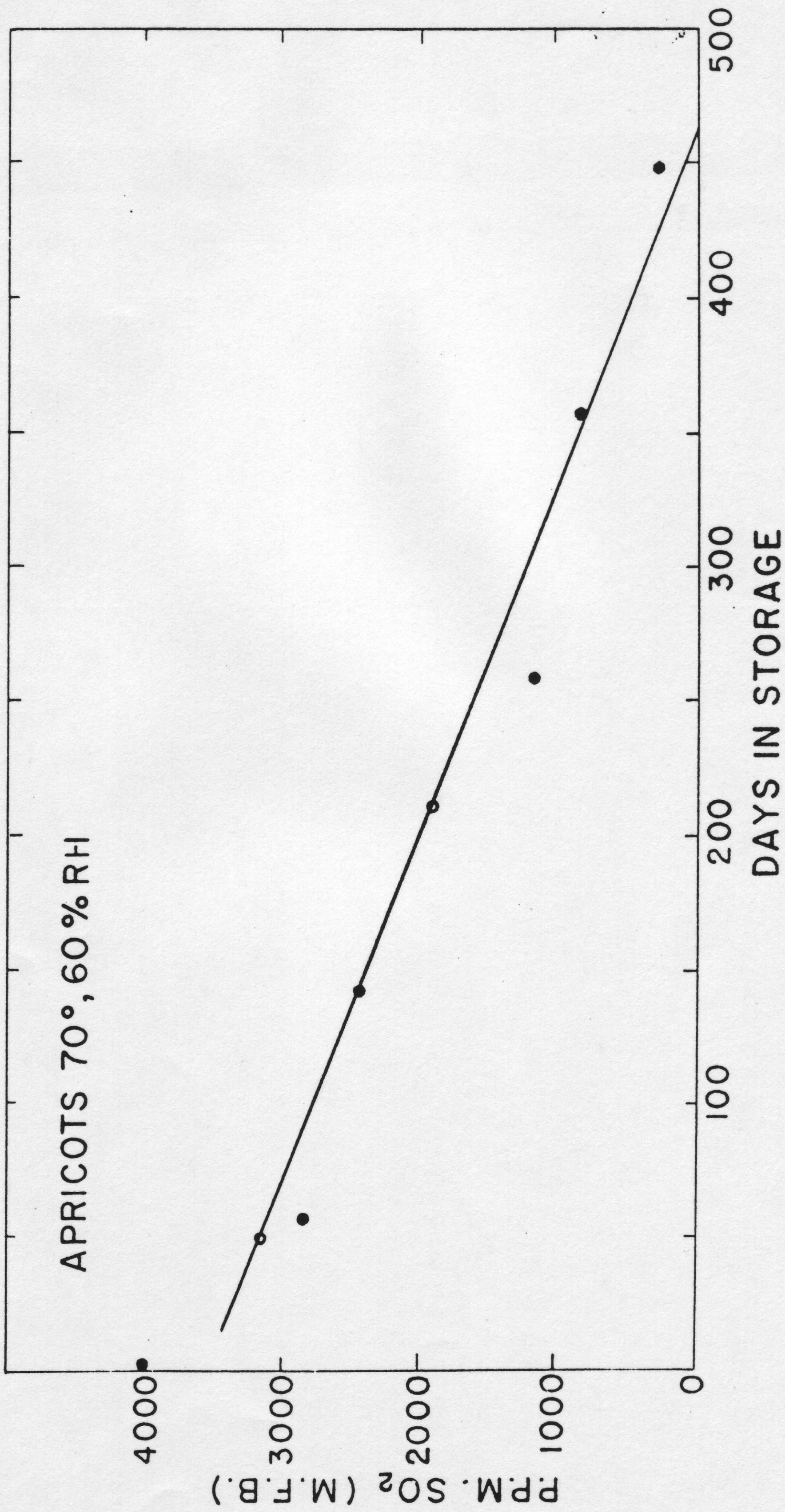
APRICOTS 70°, 60% RH
P.P.M. SO2 (M.F.B.)
4000
3000
2000
1000
0
100
200
300
400
500
DAYS IN STORAGE

Fig. 2

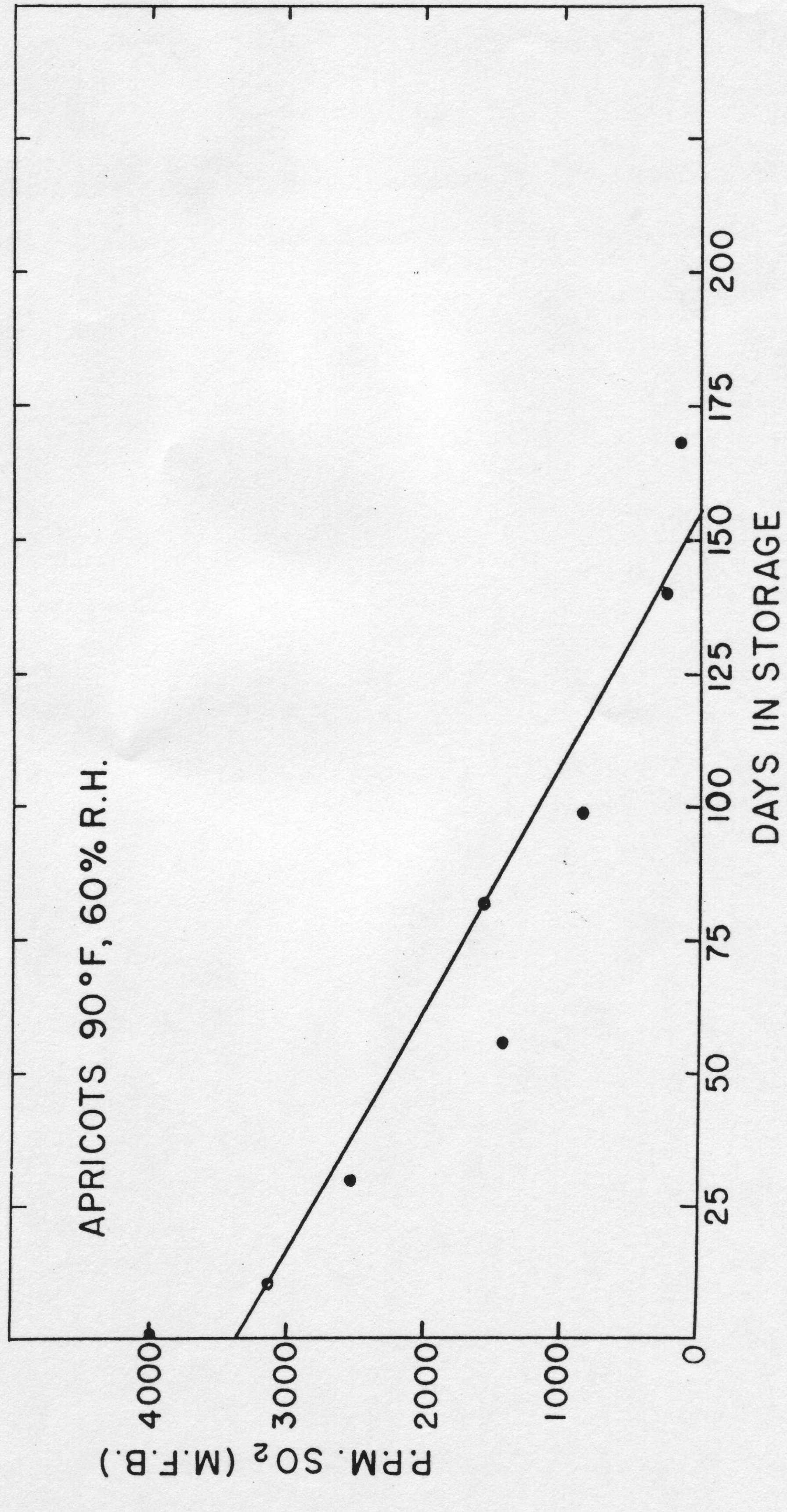
APRICOTS 90°F, 60% R.H.
DAYS IN STORAGE
25
50
75
100
125
150
175
200
P.P.M. SO2 (M.F.B.)
0
1000
2000
3000
4000

Fig. 3

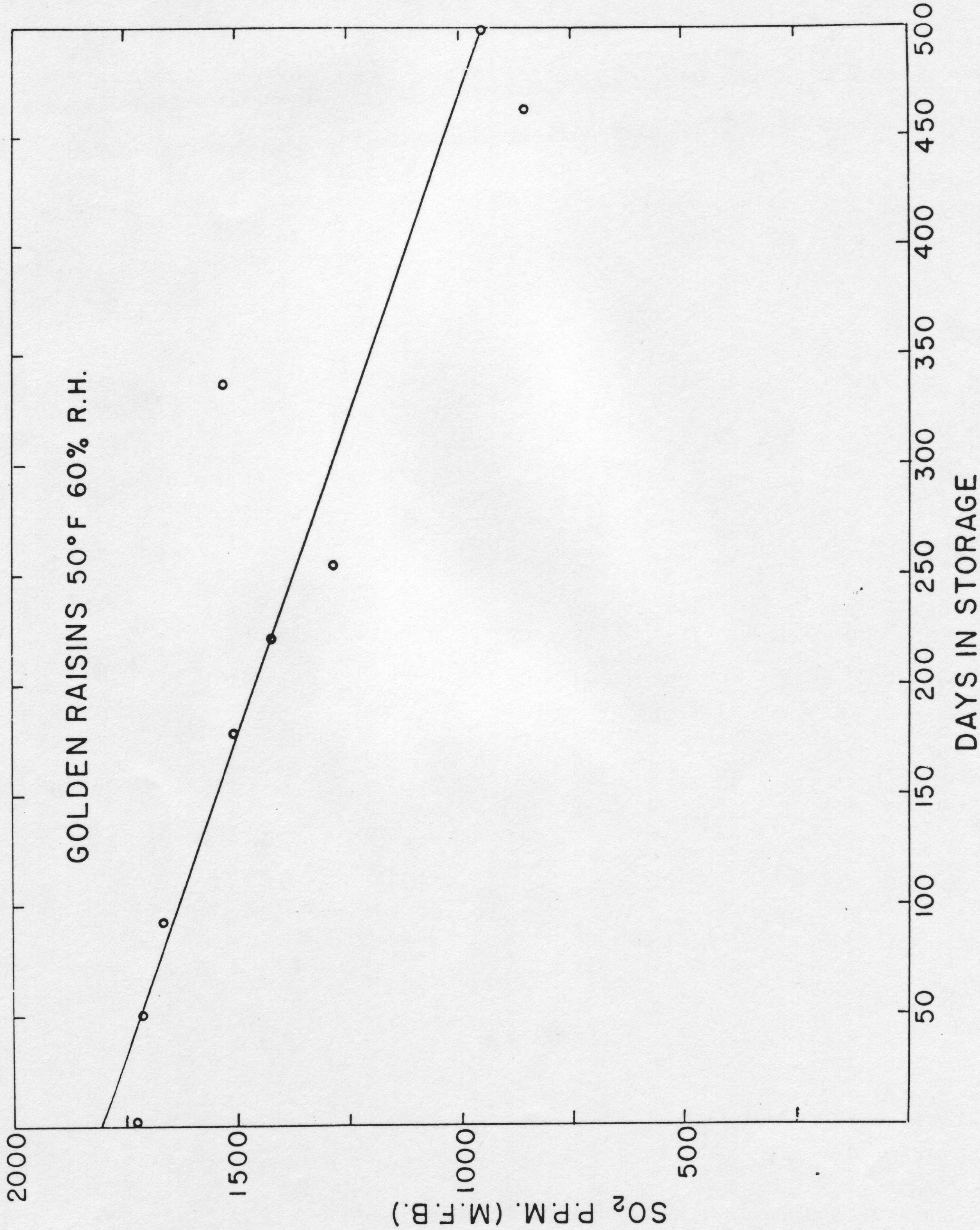
GOLDEN RAISINS 50°F 60% R.H.
SO2 P.P.M. (M.F.B.)
2000
1500
1000
500
DAYS IN STORAGE
50
100
150
200
250
300
350
400
450
500

Fig. 4

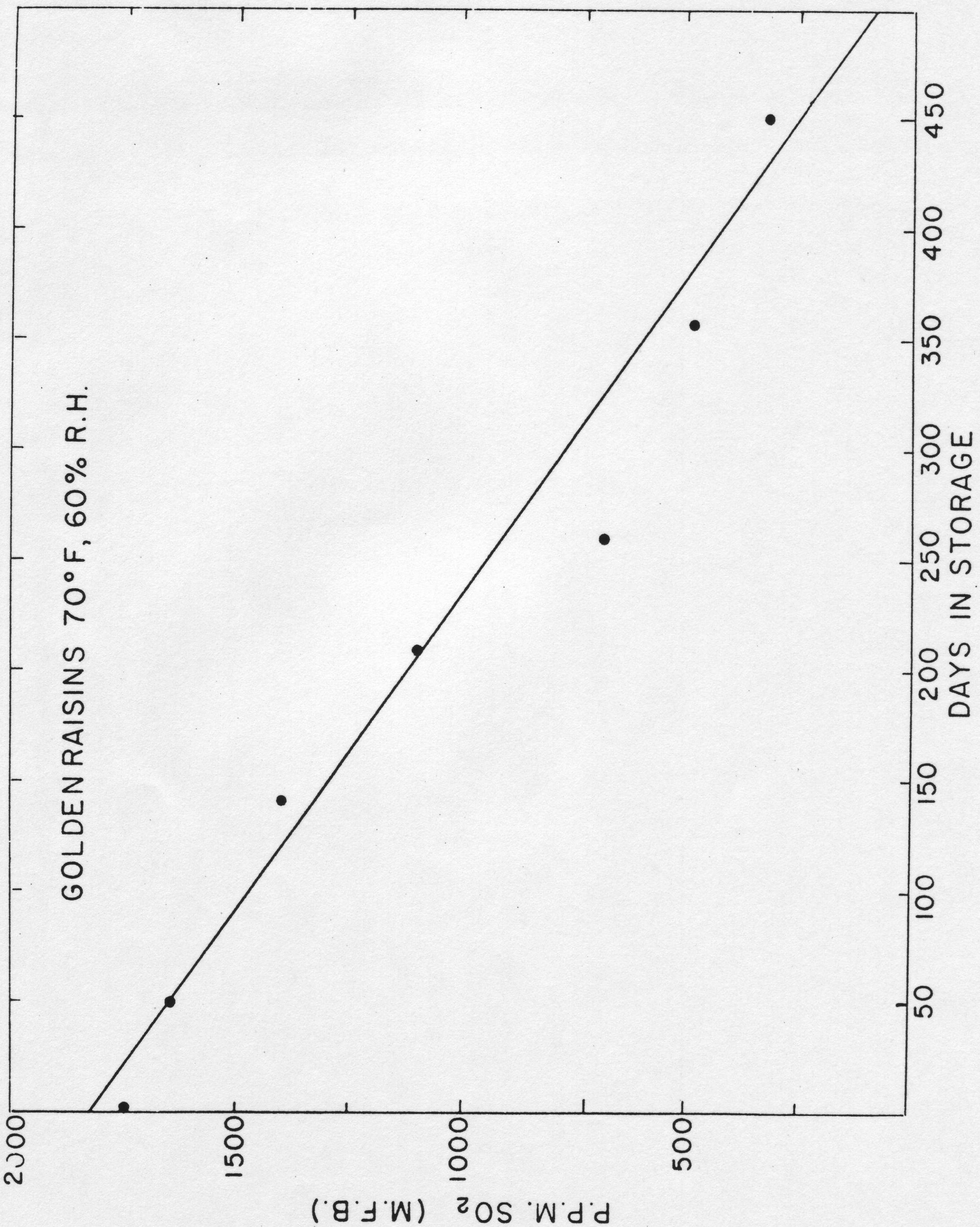
GOLDEN RAISINS 70°F, 60% R.H.
P.P.M. SO2 (M.F.B.)
2000
1500
1000
500
DAYS IN STORAGE
50
100
150
200
250
300
350
400
450

Fig. 5

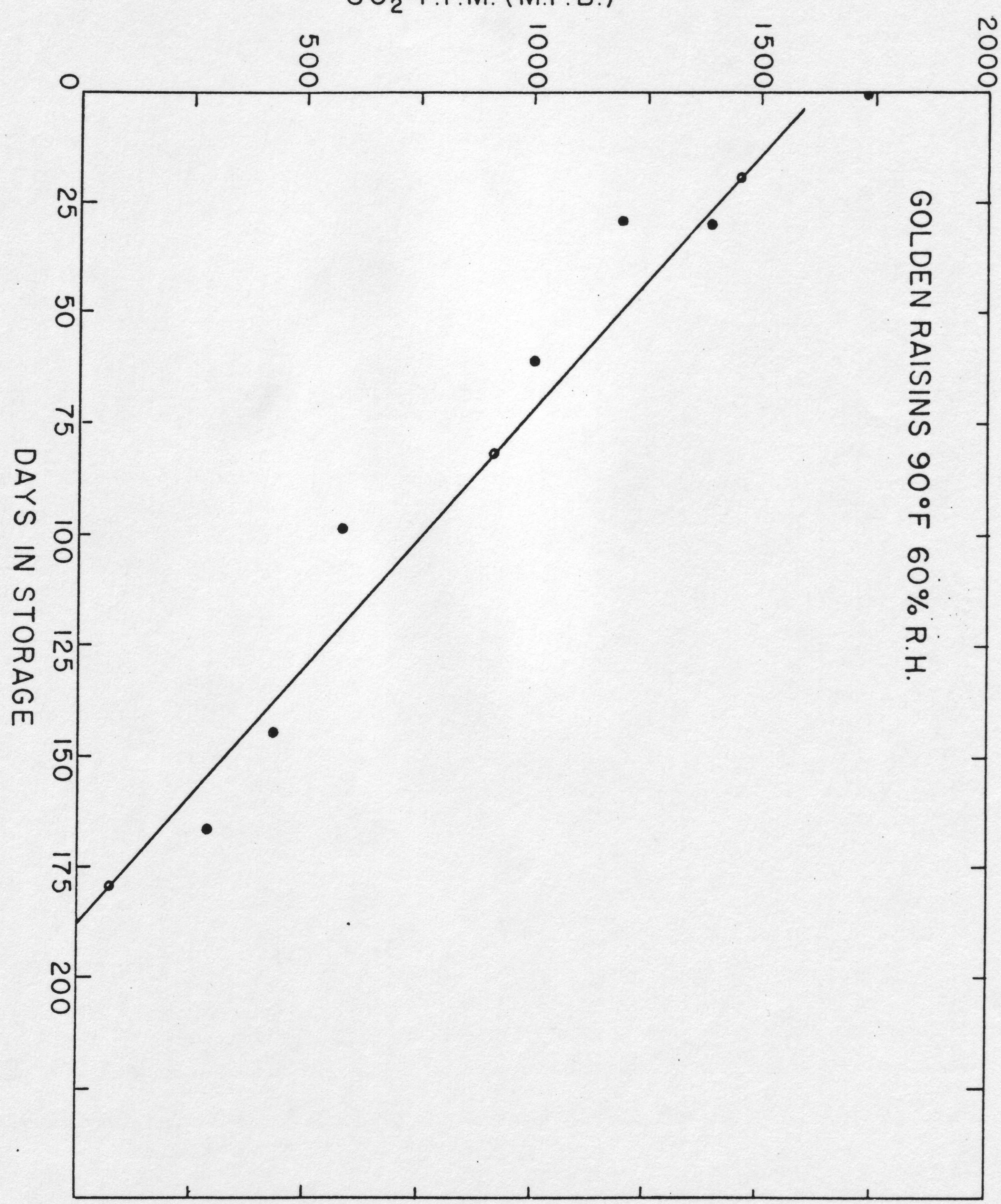
GOLDEN RAISINS 90°F 60% R.H.
SO2 P.P.M. (M.F.B.)
0
500
1000
1500
2000
25
50
75
100
125
150
175
200
DAYS IN STORAGE

Fig. 6