the vicinity. Subsequent observations and tests have proved that Mr. Robertson's surmise was correct.

During later years we have observed this same Bean Virus 2 correlation whenever snap beans were exposed to commercial plantings of gladioli. Two 1945 occurrences are illustrative. A two-acre commercial test of varieties of *P. vulgaris* for canning was planted in a portion of a large, well-tilled field near Salem, Oregon. There were no other legume crops in the area nor any apparent usual sources of Bean Virus 2. One end of the bean field was exposed to a five-acre planting of gladioli growing weed free in exceptionally good culture. The rows of beans ended about 15 feet from the gladiolus plants. An extremely severe infection of yellow bean mosaic began early in the season at the end of the planting next to the gladioli and developed into a gradient infection extending away from them to a distance of about 200 feet. All the bean plants within 50 feet of the gladioli were ruined by the mosaic. The second case occurred in a field near Portland. Two rows of snap beans, each approximately 150 yards long, were planted parallel to, and 20 feet from, rows of gladioli in a commercial field. At the end of the bean rows, and equally exposed to the gladiolus plants, was a planting of Lima beans, *P. lunatus* L. All of the snap beans and none of the Lima beans were dwarfed by necrotic and mottle strains of yellow mosaic. The significance of this field evidence is enhanced by the fact that we have been unable to prove seed transmission for any strain of Bean Virus 2.

During the war years a serious virus disease of snap beans appeared in Oregon. This disease is characterized by various necrotic symptoms which, in extreme cases, lead to the death of young plants. An investigation of this disease (*1*) and of yellow mosaic commonly associated with it has shown that the necrotic symptoms and death of plants are caused by strains of Bean Virus 2. Yellow mosaic appears to be due to a complex of Bean Virus 2 strains. Some of these have modified properties, but all form specific cytological evidence (*2*) in the foliar cells of *Vicia Faba* L. During the investigation we tested commercial gladiolus plants as sources of the yellow mosaic complex. Preliminary inoculations to *P. vulgaris* L. var. Blue Lake by the carborundum method (*3*) were not conclusive. Later trials, using plants of *V. Faba* L. as inoculates, gave transfers of 1/8, 1/9, 0/12, 0/12, 0/12, 0/20, 2/44, 0/9, 1/10, thus giving positive transmission in four out of nine trials. These cross-inoculations were made with precautions and controls that make these low percentages of transfer significant. The isolations from gladiolus included not only the typical yellow bean mosaic but also some of the necrotic types. It is very probable that the numerous plantings of gladioli in western Oregon, where beans are grown for canning, may have played some definite role in the recent epiphytotic of virulent strains of Bean Virus 2. The details of this investigation will be reported elsewhere.

All the gladiolus foliage used for preparing inocula had the usual mottle characteristic of gladiolus mosaic in commercial plantings. No virus-free gladiolus plants were available to determine whether gladiolus mosaic can be induced by inoculating gladioli with Bean Virus 2 from beans.

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Production and Treatment of Hepatitis With Focal Necrosis of the Liver in White Mice

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Different series of white mice were treated during various weeks with coal tar, an area of about $1\frac{1}{2}$ cc.^{2} being painted every second day. Some of the animals died in the first days; most of them, after 2–6 weeks. In the livers of these animals were found small, well-determined yellow spots.

Histological examination[1] revealed hepatitis and acute congestion of the organ, with zones of focal necrosis, some of them small and others extending over different lobes. In the portal areas there appeared a leucocyte reaction, with cloudy swelling and nuclear alterations, especially cariorrhexis. No other organ was affected. The percentage of animals with liver damage was rather high, as indicated in Table 1.

TABLE 1

Series No.	No. of animals	Sex	Treatment	No. of animals	
				With liver damage	Without liver damage
1	40	male	Coal tar	22	18
2	15	female	"	8	7
3	24	male	"	14	10

Sato and, later on, Forbes and Neale (*1*, *2*, *4*) have described antitoxic substances in the liver. In this laboratory we have studied the influence of liver extracts on the coal-tar-produced liver damage, using a concentrated, sour, aqueous liver extract, which had been made protein free by alcohol precipitation, and 0.1 cc. of which corresponded to 3 grams of fresh beef liver. The animals were painted three times a week with coal tar and also received injections of the liver extracts three times a week. As controls, various series of mice were treated: two series only with coal tar, and two others with

TABLE 2

Series No.	No. of animals	Sex	Treatment	No. of animals	
				With liver damage	Without liver damage
4	23	male	Coal tar Liver extract	0	23
5	20	"	"	2	18
6	20	female	"	2	20
7	31	male	"	0	31
8	10	female	Coal tar	4	6
9	14	male	"	9	5
10	6	"	Coal tar Histamine	5	1
11	10	female	Coal tar Vitamin B	2	8
12	16	male	"	9	7

[1] The author is indebted to Dr. Augusto Gast Galvis, of the Instituto de Estudios Especiales in Bogotá, for the histological studies of the livers.

vitamin B complex because of the influence of vitamin B, and especially of riboflavin, on different liver functions (*5*). Three times a week these animals received injections of 0.1 cc. of a product containing 0.2 mg. of riboflavin, 0.1 mg. of thiamine chloride, and 1 mg. of nicotinic acid. Finally, one series was treated with 0.1 mg. of histamine every second day. Our liver extract was not entirely free from histamine, and this substance could, by closing the hepatical veins (*3*) influence the origin of hepatical damages. Table 2 shows the results of these experiments.

From these results the protective influence of concentrated liver extract seems evident, while vitamin B seems to exert very little protective influence. Probably the active principle in the liver is related to the antinecrotic substances described by Forbes and Neale. In future research these relations are to be studied.

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Forty-Five Years of Continuous Cropping With Lima Beans

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The declining yields resulting from continuous cropping, which has generally been regarded as inadvisable, have usually been with nonleguminous crops. The gradual decline in wheat yields under a single cropping system in California eventually made the practice unprofitable. Experimental data on continuous cropping, accumulated from the Morrow plots (*1*) at Urbana, Illinois, have shown that corn grown continuously showed a gradual decline, the yields averaging 39.7 bushels/acre from 1888–1903 and 24.5 bushels from 1904–44—a decrease of 38 per cent. On the Sanborn field (*3*) in Missouri, there was a 39 per cent decrease in yield of timothy in the second half of a 50-year period, a 12 per cent decrease in the yield of corn, and a slight increase in wheat. However, this report indicates that recently the continuous wheat plot has produced satisfactory crops only in alternate years. Experimental work on continuous cropping in California (*2*) was conducted for only 10 years. Various nonlegume crops were used. In the cultivated crops of milo, the second 5-year period showed a decrease of 51 per cent. The yields of barley were reduced 55 per cent; rye, 43 per cent; wheat, 42 per cent; and oats, 54 per cent. In the noncultivated cereal crops, weed growth, which could be controlled in the milo plots, may also have been a factor.

In the dry Lima bean area in California, centered in Ventura County, growers have not experienced such declines. The general practice is often to plant Lima beans on the same land year after year. On one field a continuous record is available from 1901 to 1945, with the exception of 1902, when the records are not complete. This field, which consists of 235 acres, was purchased by the Samuel Edwards Associates[1] in 1882 and since then has been under continuous management of the family. Barley was probably grown prior to 1882 and large Lima beans since that time although no yield records are available prior to 1901. The soil is Yolo loam. In the early days, when the beans were threshed with stationary threshers, the straw piles were burned. Later, when orcharding came in, the straw was sold to orchardists for a winter cover. Since 1938, when the pickup threshers came into use, the straw has been scattered in the field as the beans were threshed. Irrigation after planting was not practiced until 1921. However, previous to 1921, in years of short rainfall, the land was irrigated before planting. Since then, a 4- to 6-inch application of water has been made in June or July to insure adequate moisture. During this period, with the widespread use of power equipment, other changes in farming practices have been made, one of these being to plow the dry land deeply in the fall.

At harvest, the beans were threshed, sacked, and hauled to the warehouse. The yields of the Edwards field were calculated from the receiving weights at the warehouse. The cleanout averaged 3–4 per cent. The 45-year yield record from this field is shown graphically in Fig. 1. From 1900 to 1942 the Lewis variety, or selections from it, was used; since 1943 the Ventura variety has been planted. The lowest yield, 1,018 pounds/acre, was obtained in 1904; the highest, 2,533, was obtained in 1918. The averages of the nine 5-year successive periods were 1,283; 1,553; 1,717; 2,100; 1,856; 1,836; 1,746; 1,751; and 1,827 pounds/acre. An analysis of variance showed that the variance between periods was not significant. The F value was 0.46. There was no correlation between rainfall and yield; therefore, other important factors, such as temperature, pests, diseases, and perhaps humidity, were the causes of yearly yield variations. Both wireworms and nematodes have caused some reduction in yield during some years. Because of losses from wireworms, the rate of planting has been increased from 40 pounds/acre to 80 or more in recent years. The average yield of the 45-year period

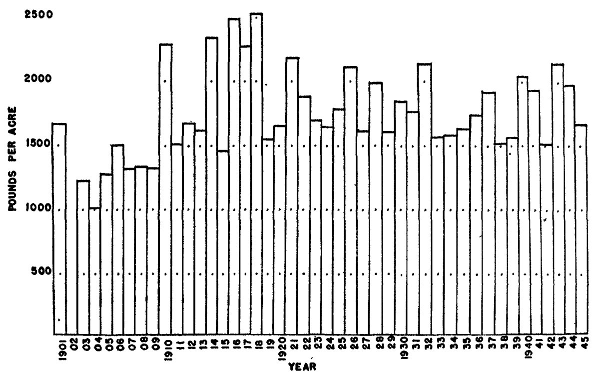

Fig. 1. Yield record of Lima beans grown continuously for 45 years on a 235-acre field in Ventura County, California.

[1] These data were made available through the kindness of the Samuel Edwards Associates, Santa Paula, California.