

## HAIL DAMAGE TO SOYBEANS

REPORT OF 1943 RESULTS

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Considerable interest has been evident in recent years in the results obtained from experiments with soybeans artificially injured to simulate hail damage. Damage by natural hailstorms to soybeans is of more than passing interest to insurance companies that underwrite farm crops. Soybeans are a comparatively new crop in the United States; their history dates back only to the early years of the present century. Likewise hail insurance of the soybean crop is only a few years old.

The problems of insurance companies in underwriting soybeans are similar to those first encountered with cotton, corn, and other crops. Adjustments of losses of these crops could not be made by any rule-of-thumb method. Most adjusters will agree that this is still true for the most part, although a considerable "bank" of experience is now available upon which adjusters may draw. However, this is not true of soybeans. Adjusters are still dependent upon trial-and-error methods, always hoping that they will not be too far off in their results. Fortunately, past experiences with other crops have been of tremendous assistance in arriving at an equitable figure in making adjustments of claims.

### PREVIOUS WORK

During the past three or four years the Illinois Agricultural Ex-

periment Station has tried to ascertain the factors attending various degrees of hail damage to beans. In cooperation with Mr. L. G. Van Zile<sup>1</sup> some field work was begun in 1942 at Urbana. Unfortunately not enough beans of any single variety were available in a sufficiently large area to provide an adequate number of replicated samples to carry through the entire season. The results obtained by using some seven or eight varieties were confusing, but followed a definite trend. This trend was toward sharply decreased yields following the flowering period and very drastic reductions when plants were damaged during pod formation and filling. These results were as expected. However, the number of varieties used made it difficult to definitely relate the date of damaging to the estimated amount of damage. Previous to this some work by G. H. Dungan et al<sup>2</sup> indicated a similar trend.

Greenhouse plants are not entirely satisfactory for hail damage experimental work. One of the most important factors affecting soybeans in greenhouse work is light. Plants tend to grow spindly and produce only a fraction of the flowers and pods ordinarily coming from a normal plant. Insects also are more serious

<sup>1</sup> Special agent for the Rain and Hail Insurance Bureau, Chicago, Illinois.

<sup>2</sup> Unpublished data.

TABLE 1.—SUMMARY OF DATA FROM HAIL DAMAGE PROJECT—ARTIFICIAL DAMAGE OF RICHLAND SOYBEANS.  
(Planted June 7, 1943—Urbana, Illinois)

	Dates of Defoliation						
	June 29	July 12	July 19	July 24	Aug. 11	Aug. 26	Sept. 6
	bu/A	bu/A	bu/A	bu/A	bu/A	bu/A	bu/A
	<b>30% Defoliation</b>						
	36.0	35.9	29.4	23.6	18.1	17.4	11.1
	25.1	27.5	27.4	29.5	15.6	20.0	10.1
	26.2	27.9	30.3	29.4	16.2	17.4	14.7
	32.6	33.7	22.4	28.6	12.3	14.7	.....
Average.....	29.9	31.5	27.4	27.7	15.6	17.4	12.0
Standard Deviation.....	4.8	3.6	3.0	2.4	2.0	1.9	1.9
	<b>50% Defoliation</b>						
	26.4	27.7	27.4	25.8	8.2	10.4	9.9
	29.0	31.3	25.5	22.6	11.2	13.8	11.0
	28.1	25.0	29.9	29.0	11.3	12.7	8.7
	36.3	29.5	27.0	22.4	10.2	11.6	10.8
Average.....	29.9	28.2	27.4	24.8	10.2	12.0	10.1
Standard Deviation.....	3.8	2.3	1.6	2.6	1.2	1.3	0.9
	<b>75% Defoliation</b>						
	24.5	23.4	.....	11.0	4.6	6.1	7.9
	24.8	24.4	.....	17.7	18.2	5.8	4.7
	19.4	27.4	.....	20.5	6.2	5.5	1.5
	24.6	23.0	.....	16.2	8.3	10.3	.....
Average.....	23.2	24.6	.....	16.3	9.3	6.9	4.7
Standard Deviation.....	2.3	1.7	.....	3.4	5.3	1.9	2.2

in the greenhouse. All of these factors and many more limit the value of greenhouse work to studies of comparative results. Treatments designed to determine the recovery of plants, bud reproduction, and other botanical phenomena are of some value.

#### WORK IN 1943

In the spring of 1943, Richland soybeans were drilled in 24-inch rows

for these studies. Although planted late (June 7) the stand was good and growth rapid. Three levels of defoliation were decided upon. These were carried out on seven different dates throughout the growing season: namely, June 29, July 12, July 19, July 24, August 11, August 26, and September 6. Random rod-row samples were defoliated. Percentages of defoliation were approximately

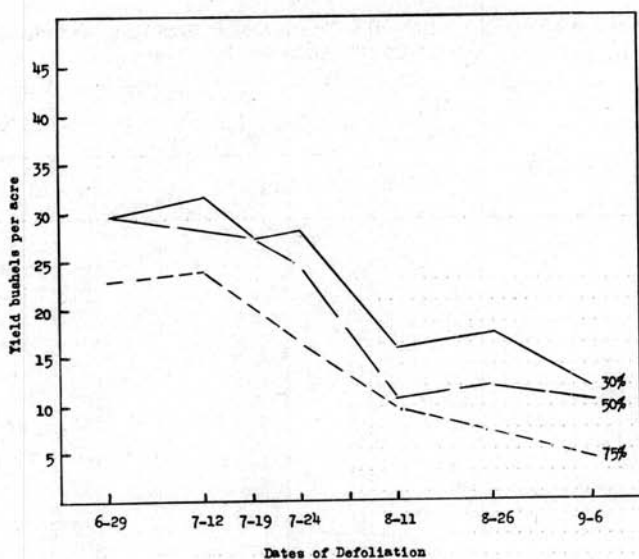


FIG. 1.—Yield of soybeans as a result of different degrees of defoliation.

30, 50, and 75, the latter entailing very rough handling, breaking of stems, etc. Insofar as was possible most of this work was carried out during the morning of the day selected as the somewhat cooler temperatures at this time of day more closely approximate conditions prevailing just prior to or during hailstorms. All defoliation was by hand as contrasted to the use of various devices in preceding years. Pertinent data are presented in Table 1 indicating yield by rows and averages in bushels per acre. Standard deviations are included.

If desired, statistical analysis can be applied, although the advantages of further statistical subjugation of these data are questionable. Figure 1 presents the same data graphically. Some question may arise as to differences seeming to favor increased yields on July 12 over June 29 under 30 percent defoliation. A comparison of the deviations will serve to

clarify these figures, for the deviation of June 29 is sufficiently large to approximately equal the yield plus deviation of July 12. Table 2 indicates the final yield of Richland beans that were not defoliated.

TABLE 2.—YIELDS OF RICHLAND SOYBEANS FROM UNDATED SAMPLES—1943

Sample	Yield bu/A
1.....	37.4
2.....	27.5
3.....	28.2
4.....	27.9
5.....	23.0
Average.....	28.8
Standard Deviation.....	4.7

#### OTHER RESULTS BEARING ON HAIL DAMAGE

One of the methods of adjusting losses caused by hailstorms is that of sampling fields and estimating

TABLE 3.—AVERAGE NUMBER OF SOYBEAN PLANTS PER ROD ROW AND AVERAGE YIELDS FROM 1/20-ACRE PLOTS. URBANA, ILLINOIS—1943.

Variety	Number of Plants Per Rod Row		Yield bu/A
	July 2	July 30	
Earlyana.....	78.5	79.0	23.0
Richland.....	85.5	81.3	24.9
Mingo.....	82.8	69.5	28.5
Mukden.....	121.0	117.8	26.4
Dunfield.....	108.5	112.3	27.5
Lincoln.....	85.5	102.0	29.4
Illini.....	160.5	157.7	26.8
Patoka.....	104.3	111.5	29.8
Viking.....	80.7	87.7	28.9
Mt. Carmel.....	111.0	105.7	30.6
Chief.....	185.5	170.0	28.1
Gibson.....	190.3	220.0	31.2
Ebony.....	210.0	179.7	12.2
McClave.....		210.3	19.9

losses based on the estimated percent of damage on a given number of plants. This brings with it the question of how many plants constitute a "stand." This is difficult to answer. Stand counts will differ with varieties on the same field. However, within reasonable limits the number of plants in a given area can differ widely and still produce at a similar rate. Table 3 gives the results of stand counts made on two different dates at Urbana and the average acre yield of beans from these plots.

Although no conclusions can be drawn at the present time from these experiments, certain definite trends are observable; namely,

1. Light hail damage during early-growth periods and previous to blossoming does not depress yields. Heavy hail damage during this same period does reduce yields very materially.

2. Severe reductions in yields resulted from all rates of defoliation during the period of pod formation and filling—August 1 to August 15, 1943.

3. The results obtained this season using Richland beans may be expected to differ slightly from other varieties which may vary in time of flowering and pod formation. However, it is considered probable that the relative yields would vary but little.