EFFECT OF FAILURE OF POLLINATION ON COMPOSITION OF CORN PLANTS [1]

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INTRODUCTION

Incomplete pollination of corn (*Zea mays* L.) is one of the greatest hazards confronting growers in the Great Plains area. It is caused by high temperature, extreme desiccation, or both, which may blast the entire tassel or kill the pollen grains after they are shed. Such conditions usually accompany what is known as a "hot wind". It frequently happens that a crop that gives an early promise of producing well will encounter these unfavorable conditions at the critical flowering period, and as a result will produce little or no grain. Under such conditions, which preclude the translocation to the grain of food synthesized in the leaves and stems, the possibility arises that the resulting barren plants may contain much more nutrient material than does ordinary corn stover. This paper reports the results of a study of this question over a period of 2 years.

REVIEW OF LITERATURE

Comparatively little information is available on the effect of interference with grain production on the composition of various parts of the corn plant. Analyses by Clark (*2*) [3] during the filling period of both sweet corn and field corn showed material and consistent increases of total solids and sucrose in the stalk juice of plants from which the ears had been removed during the milk stage. Hayes and Garber (*4*) and Hayes (*3*) found that in hand-pollinated corn there was a distinct tendency for the protein content of the grain from poorly filled ears to be higher than that from well-filled ears. Sayre, Morris, and Richey (*7*) report that the sugar content of the stem was increased by bagging ear shoots to prevent pollination. Similar results were noted in comparisons involving naturally barren plants in the drought of 1930. Loomis and Burnett (*6*) observe that the total weight of earless stalks increases much more slowly than that of comparable plants with ears. In sweet-corn plants that were prevented from pollinating, or were pollinated with sweet-corn pollen or with field-corn pollen, Kemp and Henson (*5*) found "a high carbohydrate accumulation in plants where no kernels were permitted to develop, an accumulation intermediate in quantity when sweet kernels were produced and relatively low accumulation when the plants bore dent kernels."

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[3] Reference is made by number (italic) to Literature Cited, p. 53.

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EXPERIMENTAL PROCEDURE

In 1930 the weather at Manhattan, Kans., in common with that of most of the Middle West, was too dry and hot for satisfactory corn production. The total rainfall for July amounted to only 0.57 of an inch, as compared with a normal July rainfall of 4.52 inches. Maximum temperatures of 100° F. or higher were recorded on 27 of the 37 days from July 4 to August 9, inclusive. Under these conditions pollination was very deficient and many plants produced either no grain at all or only very poorly filled ears.

Early in September 1930, after the grain was well glazed but before the leaves had dried and shattered, 12 representative plants from each of the following classes were cut from full hills in a small and reasonably uniform portion of a general field of Pride of Saline corn planted in two-plant hills, 42 by 42 inches, at the agronomy farm of the Kansas Agricultural Experiment Station: (1) Plants with well-filled ears, (2) plants with poorly filled ears, and (3) plants with practically no grain.

These plants were dried in a steam-heated room until thoroughly air-dry. Each class was then separated into leaves (including sheaths), stems (including tassels), cobs, and grain. These various parts from each class of plants were weighed, ground, mixed, and analyzed. The analytical methods used throughout were those outlined in the methods of analysis of the Association of Official Agricultural Chemists (*1*).

In order to reduce avoidable variation, a better controlled experiment was planned for the following year. Two single-cross hybrids, one of an early variety (Freed white dent 37×33) and one of a full-season variety (Pride of Saline 42×53) were used. Each hybrid was planted in a row that was fertilized and also in a row that was not fertilized. The fertilizer consisted of superphosphate at the rate of 150 pounds per acre and ammonium sulphate at the rate of 37.5 pounds per acre applied in the row at the time of planting, and an additional application of ammonium sulphate at the rate of 37.5 pounds per acre near the row when the plants were about knee high. Plants were spaced singly, 20 inches apart, in 42-inch rows. An almost perfect stand resulted, and only those portions of the rows in which the stand was complete were used.

In all four rows every alternate plant was prevented from setting seed by bagging the ear shoots as soon as they appeared. Where fertilization of the main ear was not accomplished, secondary ear shoots and adventitious buds kept developing for over 3 weeks. In spite of all reasonable precautions a few kernels developed in sucker tassels and elsewhere on some of the bagged plants, as indicated in table 1. In both crosses complete prevention of grain production was more difficult to accomplish in the fertilized than in the unfertilized rows. Early in September, 8 plants with bagged ear shoots and 8 wind-pollinated plants from each row were cut, dried, separated, weighed, and analyzed, as in the previous year.

As 1931 also proved to be unfavorable enough to produce a considerable proportion of unfilled and poorly filled ears under natural conditions, samples of 12 plants bearing well-filled ears and 12 plants bearing poorly filled ears were selected from the general field and treated as described for 1930.

RESULTS AND DISCUSSION

The analyses and weights of water-free material in each of the four parts of the various samples of corn plants are shown in table 1. In addition, a final column indicates the approximate grain yields of the different samples in bushels per acre.

TABLE 1.—*Analyses and weights of various samples of corn plants and approximate yield of grain*

Sample: Source, year, and class or treatment	Sample: Number of plants	Sample: Part analyzed	Protein (N× 6.25)	Crude fat	Crude fiber	Ash	Nitrogen-free extract	Dry weight	Approximate yield per acre
General field, 1930:			*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams*	*Bushels*
Well-filled ears	12	Grain	12.66	5.64	2.38	1.69	77.63	2,475	64.7
		Cobs	3.25	.60	34.41	2.07	59.67	764	
		Stems	8.01	1.48	33.34	5.58	51.59	959	
		Leaves	7.77	1.60	27.76	10.20	52.67	1,666	
Poorly filled ears	12	Grain	14.17	4.78	2.08	1.74	77.23	478	12.5
		Cobs	5.26	.84	29.34	2.45	62.11	497	
		Stems	10.13	1.64	30.34	4.04	53.85	1,087	
		Leaves	8.21	1.35	25.35	9.58	55.51	1,410	
Practically no grain	12	Grain	15.29	4.47	2.58	1.74	75.92	78	2.0
		Cobs	9.19	.98	25.08	3.40	61.35	379	
		Stems	11.78	.86	27.14	3.79	56.43	1,235	
		Leaves	9.56	1.42	24.16	8.10	56.76	1,808	
General field, 1931:									
Well-filled ears	12	Grain	12.66	4.43	1.85	1.57	79.49	2,363	61.7
		Cobs	2.77	.17	35.95	1.75	59.36	703	
		Stems	7.92	1.39	33.96	6.14	50.59	1,558	
		Leaves	6.07	1.10	29.72	10.89	52.22	1,582	
Poorly filled ears	12	Grain	14.03	4.37	2.41	1.99	77.20	407	10.6
		Cobs	8.06	.40	28.50	3.03	60.01	303	
		Stems	10.92	1.35	30.83	4.63	52.27	1,600	
		Leaves	7.54	1.16	27.15	10.43	53.72	1,831	
Pride of Saline 42×53, 1931:									
With fertilizer, wind-pollinated.	8	Grain	12.61	4.61	1.98	1.61	79.19	1,537	63.3
		Cobs	4.44	.39	33.23	2.00	59.94	568	
		Stems	10.11	1.18	36.31	4.89	47.51	759	
		Leaves	9.02	1.41	28.44	10.32	50.81	1,631	
With fertilizer, bagged	8	Grain	14.88	4.00	2.47	1.91	76.74	108	4.4
		Cobs	11.86	.67	22.83	3.68	60.96	465	
		Stems	13.78	1.09	30.78	4.04	50.31	849	
		Leaves	10.71	1.37	26.11	9.16	52.65	1,557	
Without fertilizer, wind-pollinated.	8	Grain	12.88	4.66	1.91	1.65	78.90	1,454	59.8
		Cobs	4.72	.49	32.19	1.86	60.74	538	
		Stems	10.53	1.04	32.01	4.67	51.75	919	
		Leaves	9.13	1.44	27.10	9.83	52.50	1,513	
Without fertilizer, bagged.	8	Grain	15.93	3.88	3.23	2.01	74.95	11	.5
		Cobs	12.57	.89	20.66	3.90	61.98	296	
		Stems	13.67	1.06	28.11	4.03	53.13	876	
		Leaves	10.12	1.23	27.18	8.78	52.69	1,375	
Freed white dent 37×33, 1931:									
With fertilizer, wind-pollinated	8	Grain	14.36	4.81	2.23	1.69	76.91	856	35.2
		Cobs	5.59	.73	31.85	2.47	59.36	401	
		Stems	11.85	1.01	27.50	6.19	53.45	796	
		Leaves	8.89	1.56	27.59	10.20	51.76	1,196	
With fertilizer, bagged	8	Grain	15.65	4.06	2.63	1.86	75.80	15	.6
		Cobs	14.92	.96	21.95	4.97	57.20	747	
		Stems	13.84	.74	26.11	5.56	53.75	979	
		Leaves	9.68	1.64	27.10	9.24	52.34	1,532	
Without fertilizer, wind-pollinated.	8	Grain	14.21	4.86	2.14	1.65	77.14	752	30.9
		Cobs	5.40	.57	31.21	2.11	60.71	324	
		Stems	10.38	1.00	27.13	5.48	56.01	775	
		Leaves	7.66	1.56	27.45	10.28	53.05	1,004	
Without fertilizer, bagged.	8	Grain	------	------	------	------	------	------	.0
		Cobs	13.90	.78	20.86	4.48	59.98	221	
		Stems	12.11	1.05	25.52	4.84	56.48	853	
		Leaves	10.52	1.55	25.88	9.77	52.28	1,004	

A number of relationships seem to stand out consistently in the data. In every part of the corn plant considered—grain, cobs, stems, and leaves—the protein content of the parts from plants with poorly filled ears is uniformly higher than that of the corresponding parts from plants with well-filled ears. The increase in protein is greatest in the cobs. In Freed white dent 37×33 grown with fertilizer, the percentage of protein rose from 5.59 in cobs of well-filled ears to 14.92 in cobs from the bagged plants, even though the cobs from the bagged plants weighed nearly twice as much as those from the unbagged plants. The protein content of the cobs from bagged plants is approximately that commonly reported for alfalfa hay and wheat bran.

The differences in ether extract and crude fat are small and inconsistent except in the grain and the cobs. In a normally developed corn plant most of the fat produced is stored in the embryos of the grain. The tendency for the grain of the poorly filled ears to have a lower fat content probably is due to the greater proportional development of endosperm in the large round kernels characteristic of such ears. Although the fat content of the cobs in no case reaches 1 percent, the poorly filled cobs have the higher percentage of crude fat in all cases. The stems and leaves show little or no tendency to store additional fat in cases where grain is prevented from being formed.

The crude fiber content of plants with poorly filled ears tends to be higher in the grain and lower in other parts of the plants than that of plants with well-filled ears. The difference is most marked in the cobs, those from well-filled ears having approximately half again as much crude fiber as those from poorly filled ears.

The ash content of grain, and especially of cobs, was consistently higher, while that of stems and leaves was lower, in plants with poorly filled ears. In the grain and cobs the ash comparisons parallel the protein comparisons, but in the stems and leaves an opposite situation exists with respect to these two constituents.

The percentage of nitrogen-free extract is slightly less in the grain, about the same in the cobs, and greater in the stems and leaves of plants bearing poorly filled ears than of plants with well-filled ears.

A summary of the data shows that the grain from the poorly filled ears is higher in protein, fiber, and ash, and lower in fat and nitrogen-free extract than the grain from well-filled ears; the cobs from the poorly filled ears show the greatest deviations from normal of any part, being unusually high in protein and ash, high in fat, and very low in fiber; the stems of plants bearing poorly filled ears are higher in protein and nitrogen-free extract and lower in fiber and ash; the leaves of plants bearing poorly filled ears are higher in protein, slightly higher in nitrogen-free extract, slightly lower in fiber, and lower in ash.

Not much effect on the various parts of the corn plant is evident from the use of fertilizer. In only the following five cases were changes in composition, presumably due to fertilizer, consistent in all four possible comparisons: The fiber content of (1) cobs and (2) stems was lower, (3) the ash content of stems was higher, and the nitrogen-free-extract content of (4) cobs and (5) stems was lower where fertilizer was applied than where it was not. When fertilizer was applied, the total dry weight was greater in all comparisons except in the stem weight of the Pride of Saline single cross. It is probable that the increase in weight of the plant parts due to the increased mineral fertilizer available kept pace with the greater absorption of the minerals so that little or no change in percentage composition is noticeable. For most of the analyses, more marked variations in composition seem to have resulted from failure to set seed than from row fertilization at the rates used. When normal translocation of synthesized food to the grain is prevented, the food tends to pile up in other parts of the plant, particularly in the cobs. Consequently the proportion of fiber, especially in the cobs and to a less extent in stems and leaves, is much lower. There is a distinct difference in the behavior of various substances, however, since the protein, fat, and ash tend to accumulate in the cobs of poorly filled ears, whereas only protein and nitrogen-free extract tend to accumulate in greater than normal proportions in the stems and leaves.

One of the important practical considerations concerning corn with poorly filled ears is its relative feeding value as compared with that of normally filled corn. Although no feeding tests were conducted in this experiment, fairly accurate comparisons may be obtained from the relative amounts of the various nutrients involved in each case. For this purpose, from a total of 100 pounds of water-free fodder of each sample the number of pounds of each nutrient for each part analyzed has been calculated from the basic data of table 1. These calculated amounts are shown in table 2.

TABLE 2.—*Weight of various constituents per 100 pounds of total weight of dry corn fodder as calculated from table 1*

Sample: Source, year, and class or treatment	Sample: Part analyzed	Protein (N× 6.25)	Crude fat	Crude fiber	Ash	Nitrogen-free extract	Total
General field, 1930:		*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Well-filled ears	Grain	5.35	2.38	1.00	0.72	32.77	42.22
	Cobs	.42	.08	4.48	.27	7.77	13.02
	Stems	1.31	.24	5.44	.95	8.43	16.37
	Leaves	2.21	.46	7.87	2.90	14.95	28.39
	Total	9.29	3.16	18.79	4.84	63.92	100.00
Poorly filled ears	Grain	1.95	.66	.29	.24	10.61	13.75
	Cobs	.75	.12	4.20	.35	8.89	14.31
	Stems	3.17	.51	9.50	1.27	16.85	31.30
	Leaves	3.34	.55	10.29	3.89	22.57	40.64
	Total	9.21	1.84	24.28	5.75	58.92	100.00
Practically no grain	Grain	.34	.10	.06	.04	1.68	2.22
	Cobs	.99	.11	2.74	.37	6.66	10.87
	Stems	4.16	.30	9.60	1.34	19.91	35.31
	Leaves	4.94	.73	12.50	4.18	29.25	51.60
	Total	10.43	1.24	24.90	5.93	57.50	100.00
General field, 1931:							
Well-filled ears	Grain	4.82	1.69	.70	.60	30.26	38.07
	Cobs	.31	.02	4.07	.20	6.73	11.33
	Stems	1.99	.35	8.52	1.54	12.72	25.12
	Leaves	1.55	.28	7.58	2.76	13.31	25.48
	Total	8.67	2.34	20.87	5.10	63.02	100.00
Poorly filled ears	Grain	1.38	.43	.24	.20	7.58	9.83
	Cobs	.59	.03	2.09	.22	4.39	7.32
	Stems	4.22	.52	11.91	1.79	20.20	38.64
	Leaves	3.33	.51	12.01	4.61	23.75	44.21
	Total	9.52	1.49	26.25	6.82	55.92	100.00

TABLE 2.—*Weight of various constituents per 100 pounds of total weight of dry corn fodder as calculated from table 1*—Continued

Sample: Source, year, and class or treatment	Sample: Part analyzed	Protein (N×6.25)	Crude fat	Crude fiber	Ash	Nitrogen-free extract	Total
Pride of Saline 42×53, 1931		*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
With fertilizer, wind-pollinated	Grain	4.31	1.58	0.67	0.55	27.05	34.16
	Cobs	.56	.05	4.20	.25	7.58	12.64
	Stems	1.71	.20	6.13	.83	8.03	16.90
	Leaves	3.27	.51	10.32	3.74	18.46	36.30
	Total	9.85	2.34	21.32	5.37	61.12	100.00
With fertilizer, bagged	Grain	.54	.15	.09	.07	2.78	3.63
	Cobs	1.85	.10	3.56	.58	9.52	15.61
	Stems	3.93	.31	8.77	1.15	14.34	28.50
	Leaves	5.60	.72	13.65	4.79	27.50	52.26
	Total	11.92	1.28	26.07	6.59	54.14	100.00
Without fertilizer, wind-pollinated	Grain	4.23	1.53	.63	.54	25.94	32.87
	Cobs	.57	.06	3.91	.23	7.39	12.16
	Stems	2.19	.22	6.65	.97	10.75	20.78
	Leaves	3.12	.49	9.27	3.36	17.95	34.19
	Total	10.11	2.30	20.46	5.10	62.03	100.00
Without fertilizer, bagged	Grain	.07	.02	.01	.01	.32	.43
	Cobs	1.45	.10	2.39	.45	7.17	11.56
	Stems	4.68	.36	9.63	1.38	18.20	34.25
	Leaves	5.44	.66	14.61	4.72	28.33	53.76
	Total	11.64	1.14	26.64	6.56	54.02	100.00
Freed white dent 37×33, 1931.							
With fertilizer, wind-pollinated	Grain	3.78	1.27	.59	.45	20.27	26.36
	Cobs	.69	.09	3.93	.30	7.32	12.33
	Stems	2.90	.25	6.74	1.52	13.09	24.50
	Leaves	3.27	.57	10.16	3.75	19.06	36.81
	Total	10.64	2.18	21.42	6.02	59.74	100.00
With fertilizer, bagged	Grain	.07	.02	.01	.01	.35	.46
	Cobs	3.40	.22	5.01	1.13	13.06	22.82
	Stems	4.14	.22	7.81	1.66	16.07	29.90
	Leaves	4.53	.77	12.69	4.33	24.50	46.82
	Total	12.14	1.23	25.52	7.13	53.98	100.00
Without fertilizer, wind-pollinated	Grain	3.74	1.28	.56	.43	20.33	26.34
	Cobs	.61	.06	3.54	.24	6.89	11.34
	Stems	2.82	.27	7.37	1.49	15.20	27.15
	Leaves	2.69	.55	9.65	3.62	18.66	35.17
	Total	9.86	2.16	21.12	5.78	61.08	100.00
Without fertilizer, bagged	Grain						
	Cobs	1.48	.08	2.22	.48	6.38	10.64
	Stems	4.97	.43	10.48	1.99	23.18	41.05
	Leaves	5.08	.75	12.51	4.72	25.25	48.31
	Total	11.53	1.26	25.21	7.19	54.81	100.00

Although in all comparisons the protein of the grain of poorly filled ears is less because of the greatly reduced proportion of grain, the total amount of protein per 100 pounds of fodder is greater in the low-grain samples. Thus silage made from poorly filled corn actually would have a higher content of this valuable nutrient, pound for pound, than silage from normally filled corn.

The total fat per 100 pounds of fodder is less in all cases from the corn with poorly filled ears. In the stover alone, however, the fat content of the samples with poorly filled ears is slightly higher.

The total fiber content is somewhat greater in all cases for the samples with poorly filled ears. The greater proportion of stems and leaves, which are the principal sources of fiber in the plant, more than compensates for the smaller percentage of fiber in these organs.

The total ash per 100 pounds of fodder is greater in all cases in the samples with poorly filled ears.

The total nitrogen-free extract per 100 pounds is less in all the samples with poorly filled ears than in corresponding samples with normally filled ears. This condition would be expected because of the extremely high carbohydrate content of the grain, which normally contains one-third to one-half of the total nitrogen-free extract of the plants. The nitrogen-free extract of the stover, however, is higher in the samples with poorly filled ears.

Thus far, attention has been directed almost entirely to the composition of the corn plant and the relative proportions of the different constituents in the various parts analyzed. Just as important from a practical standpoint is the effect of incomplete pollination on the forage weight and total dry weight produced. Table 3 presents these data on an acre basis as calculated from the basic data given in table 1. In order to simplify the comparisons, the various parts have been combined to show only grain, stover, and total fodder. The cobs might have been combined either with the grain as ear corn or with the stover. The latter procedure was decided upon, since the cobs contain comparatively little nutriment in the case of well-filled ears and in the case of poorly filled or unfilled ears they would probably be left with the stover.

TABLE 3.—*Effect of incomplete pollination on dry grain weight, stover weight, and total weight of corn plants*

Source of plant, sample, and year grown	Plant part	Yields per acre from corn plants grown—				
		With fertilizer		Without fertilizer		
		Well-filled ears	Practically no grain	Well-filled ears	Poorly filled ears	Practically no grain
		Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
General field, 1930	Grain			3,234	625	102
	Stover and cobs			4,428	3,912	4,471
	Total			7,662	4,537	4,573
General field, 1931	Grain			3,088	532	
	Stover and cobs			5,021	4,879	
	Total			8,109	5,411	
Pride of Saline 42×53, 1931	Grain	3,163	222	2,992		23
	Stover and cobs	6,087	5,908	6,112		5,241
	Total	9,250	6,130	9,104		5,264
Freed white dent 37×33, 1931	Grain	1,761	31	1,547		0
	Stover and cobs	4,924	6,704	4,328		4,276
	Total	6,685	6,735	5,875		4,276

In the samples from the general field for both years, the plants with poorly filled ears produced less stover and less total weight than did the plants with well-filled ears. Strangely enough, the plants with practically no grain in 1930 produced slightly more stover than did those with well-filled ears, although the total dry weight of the grain and stover was less than two-thirds of that of the plants with the well-filled ears. Possible explanations of this discrepancy are (1) that the number of plants used was too small for an adequate sample and (2) that with an open-pollinated variety there may be a tendency for vegetative vigor to be correlated with a predisposition to barrenness.

In the Pride of Saline single cross, where the variability of an open-pollinated variety does not obtain, there is a definite tendency for the stover and fodder weights to be less for the plants with poorly filled ears, both with and without fertilizer, but especially for the latter. A similar trend also is noted in the single cross of Freed white dent when grown without fertilizer. This same cross, however, when grown with fertilizer produced considerably more stover and slightly greater total weight in the plants with poorly filled ears than in the plants with well-filled ears. This is the only comparison in which the plants with poorly filled ears produced the greater fodder weight. It seems, therefore, that although the prevention of setting of grain may have a variable effect on the amount of dry matter produced in other parts of the plant, well-filled ears are usually associated with the greatest production of dry matter per acre, and at least very frequently the stover yield is depressed somewhat by the failure of the ears to be well filled.

In order to summarize the combined effect of incomplete pollination on weight and composition, the pounds per acre of the various chemical constituents produced in the entire plant are shown in table 4. Total fat produced per acre is greatly depressed in all comparisons when grain is not allowed to set normally. Nitrogen-free extract per acre also is always lower for plants with poorly filled ears. Production of protein, fiber, and ash, and the total weight of fodder per acre are depressed by incomplete pollination in all cases but one, namely, Freed white dent 37×33 grown with fertilizer. This exceptional behavior may be due to soil heterogeneity or other uncontrolled factors.

TABLE 4.—*Total weights of various constituents from entire plants produced per acre*

Source, year, class, and treatment of plant sample	Weight per acre of—					
	Protein	Crude fat	Crude fiber	Ash	Nitrogen-free extract	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
General field, 1930:						
Well-filled ears	712	242	1,440	371	4,897	7,662
Poorly filled ears	418	83	1,102	261	2,673	4,537
Practically no grain	477	57	1,139	271	2,629	4,573
General field, 1931:						
Well-filled ears	703	190	1,692	414	5,110	8,109
Poorly filled ears	515	81	1,420	369	3,026	5,411
Pride of Saline 42×53, 1931:						
With fertilizer:						
Well-filled ears	911	216	1,972	497	5,654	9,250
Poorly filled ears	731	78	1,598	404	3,319	6,130
Without fertilizer:						
Well-filled ears	921	209	1,863	464	5,647	9,104
Poorly filled ears	613	60	1,402	345	2,844	5,264
Freed white dent 37×33, 1931:						
With fertilizer:						
Well-filled ears	711	146	1,432	402	3,994	6,685
Poorly filled ears	818	83	1,719	480	3,635	6,735
Without fertilizer:						
Well-filled ears	579	127	1,241	340	3,588	5,875
Poorly filled ears	493	54	1,078	307	2,344	4,276

SUMMARY

When set of grain in corn plants is prevented or reduced by prevention of normal pollination, protein in particular and to a less extent nitrogen-free extract tend to accumulate in greater than normal proportions in other organs of the plant, and the proportion of fiber is considerably reduced, particularly in the cobs and stems. The composition of the cob is influenced more than that of other parts of the plant, being considerably higher in protein, fat, and ash and lower in fiber in the plants with poorly filled ears.

Fodder from plants with poorly filled ears contained more protein and ash, slightly more fiber, and less fat and nitrogen-free extract than equal weights of fodder from plants with well-filled ears. The analyses indicate that, pound for pound, silage or fodder from a corn crop in which pollination has been prevented is higher in protein and ash content and nearly as high in energy values as from a crop with a full set of grain.

From chemical analyses it appears that stover from plants with poorly filled ears has an appreciably better feeding value than an equal weight of stover from plants with well-filled ears.

In all but one comparison the acre yield of fodder was depressed considerably where normal pollination and grain production were prevented. Although there are two exceptions, the acre yield of stover tended to be depressed slightly in samples with poorly filled ears.

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