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**COTTON GIN FIRES IN
ARIZONA, CALIFORNIA AND NEW MEXICO
1956-57 to 1958-59**



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SUMMARY

Cotton gin fires in the United States cause economic losses of millions of dollars each year. In the three states of California, Arizona and New Mexico combined, losses from cotton fires are estimated to average a half million dollars annually. Although processing fires occurring within the gin plant itself were most frequent, seed cotton fires occurring between the time cotton is picked and the time it enters the gin plant generally caused the greatest losses. Fires in baled cotton occurring between the time cotton leaves the gin press and reaches the warehouse were relatively less frequent and less serious, but contributed substantially to the over-all fire loss.

The information on which these general conclusions are based was obtained from a sample of well over half of the cotton gins in the three western states of Arizona, California and New Mexico and covers the seasons 1956-57 through 1958-59. In addition to showing the nature and extent of gin fires, the information indicates the relative effectiveness of different types of fire prevention and control devices.

During this study a total of 4,589 cotton gin fires was reported: 2,099 in Arizona, 1,819 in California and 671 in New Mexico. This was an average of 8.1, 7.0 and 4.7 fires per gin per season, respectively.

For the three seasons combined, gin processing fires accounted for 62, 58 and 78 percent of the total of fires at sample gins in Arizona, California and New Mexico, respectively. Seed cotton fires were next in importance followed by baled cotton fires which ranged from 5 percent of the total fires in New Mexico to 12 percent of those reported in Arizona.

Losses from all types of gin fires for the three seasons totaled \$333,235 for the sample gins in Arizona, \$240,586 for those in California and \$115,746 for those in New Mexico. The average loss per gin was \$1,287, \$929 and \$809 in Arizona, California and New Mexico, respectively. Seed cotton accounted for about 43 percent of the total cotton fire losses in Arizona and California while baled cotton fires were responsible for 25 percent of the losses suffered in California and New Mexico.

Losses for all types of fires combined averaged \$159 per fire in Arizona, \$132 in California and \$173 in New Mexico and total losses per 1,000 bales ginned averaged \$208, \$148 and \$186 in Arizona, California and New Mexico, respectively.

Most of the gin processing fires originated in overhead cleaners and gin stands with matches being reported as responsible for 73 percent of all processing fires which could be identified by cause. These fires were comparatively small, resulting in losses of less than \$50.00 each. Most of these losses were sustained by the cotton products themselves, namely seed cotton, cotton lint and cottonseed. Processing fire losses amounted to about 5 cents per bale in Arizona and California and nearly 11½ cents per bale in New Mexico.

Green boll traps and magnets were not effective in the western area in preventing processing fires. Gins with one or both of these

devices and gins with neither device had on an average 1 fire for every 1,333 bales ginned and 4.3 fires per gin. However, permanent carbon dioxide systems were effective in reducing losses from processing fires. Losses for gins with CO₂ systems averaged \$70 per fire compared to \$80 per fire for gins not so equipped. Annual losses averaged \$235 for gins with CO₂ compared to \$360 for gins without this system.

In Arizona and California, the number of processing fires per 1,000 bales ginned declined from 1.6 fires to 0.1 fires as the rate of ginning increased from only a few bales per week up to 1,400 or 1,500 bales. In New Mexico there was no consistent tendency for the number of fires to increase or decrease as the rate of ginning increased.

The incidence of gin processing fires was much lower in machine picked cotton. For the three seasons, combined, Arizona and California gidders processed roughly 6.5 times as many bales of machine picked cotton per fire as for that picked by hand.

Most seed cotton fires reported in the three western states occurred either in the field or in trailers en route to the gin. Smoking, sparks and matches combined accounted for 99 percent of these fires in New Mexico and 85 per cent of those occurring in Arizona and California. Forty-six percent of the seed cotton fires in Arizona, 64 percent in California and 68 percent of those in New Mexico resulted in losses of less than \$100 each.

About 58 percent of all baled cotton fires in California and Arizona resulted in losses ranging between \$100 and \$200 per fire, while in New Mexico, 50 percent of the baled cotton fires resulted in heavier losses of \$500 or more.

COTTON GIN FIRES IN ARIZONA, CALIFORNIA AND NEW MEXICO

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Cotton gin fires² in the United States cause economic losses of millions of dollars annually. Along with a few large fires which result in heavy losses to gin buildings, machinery and even baled cotton an undetermined number of smaller fires do relatively little damage. However, aggregate losses of cotton, cottonseed, ginning time and labor from these smaller fires amount to many thousands of dollars.

Most of these fire losses are wholly or partially protected by insurance. However, the cost of insuring against gin fire losses adds to the cost of ginning, and therefore increases the direct cost of marketing American cotton. It seems reasonable to assume that a more favorable loss ratio³ should eventually bring about a reduction in insurance costs to gins which, in turn, should enhance the competitive position of American cotton.

PURPOSE AND PLAN OF STUDY

Beginning with the 1956-57 season seven of the State Agricultural Experiment Stations in the cotton belt and the U. S. Department of Agriculture initiated a study to ascertain the incidence and cost of gin fires and the coverage and cost of gin fire insurance. This information was intended to provide ginners with guides as to possible means of reducing fire losses and insurance costs. Data for this belt-wide survey were obtained from a sample of gins in almost all of the major cotton-growing states for the three ginning seasons 1956-57 through 1958-59.

The objectives of this analysis were to determine (1) the number, locations and probable causes of cotton gin fires, (2) the amount of direct losses to ginning companies resulting from these fires and (3) the effect of fire prevention devices, method of harvest and ginning rate on the frequency and magnitude of fires in these three states.

Data for this report were obtained from slightly less than half of the combined total number of gins in Arizona and California and about three-fourths of the gins in New Mexico. The number of gins in the sample by state and ginning season were as follows:

¹Agricultural Economists, Marketing Economics Research Division, Agricultural Marketing Service, U. S. Department of Agriculture. Dr. Wilmot was an Assistant Professor with the Arizona Agricultural Experiment Station at the time this study was made. Mr. Roberts retired December 31, 1959.

²As used in this report the terms "cotton gin fires" and "gin fires" refer to fires that occur in cotton from the time it is picked in the field, during the ginning process and during the time baled cotton is stored on the gin premises or is en route to a warehouse.

³From the standpoint of the insurance industry the loss ratio represents the relationship of claims paid to premiums earned.

State	Number of Gins Included in Study		
	1956-57	1957-58	1958-59
Arizona	87	87	85
California	83	88	88
New Mexico	47	48	48
Total	217	223	221

To facilitate the analysis, cotton gin fires were classified as: gin processing fires, seed cotton fires and baled cotton fires.¹ Gin processing fires occur in the gin from the time cotton enters the suction pipe up to and including the press box. Seed cotton fires occur in seed cotton from the time of picking in the field and up to the time it is drawn into the gin suction pipe. Baled cotton fires occur in baled cotton from the time it is removed from the gin press box and during the time it is stored temporarily on the gin baleyard or en route to a warehouse.

TOTAL NUMBERS OF AND LOSSES FROM COTTON GIN FIRES

The sample gins in the three states reported 4,589 fires during the three years of the study. Arizona had 2,099, California 1,819 and New Mexico 671 fires (Table 1). This was an annual average of 8.1, 7.0 and 4.7 fires per gin, respectively.

Table 1. Fires at Sample Gins by Major Type of Fire and Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Type of Fire			Total
	Gin Processing	Seed Cotton	Baled Cotton	
	(number of fires)			
Arizona:				
1956-57	564	190	94	848
1957-58	353	186	56	595
1958-59	391	169	96	656
Total—three seasons	1,308	545	246	2,099
California:				
1956-57	323	212	67	602
1957-58	385	160	52	597
1958-59	342	212	66	620
Total—three seasons	1,050	584	185	1,819
New Mexico:				
1956-57	214	36	8	258
1957-58	141	28	7	176
1958-59	169	53	15	237
Total—three seasons	524	117	30	671

¹This classification was based on the types of insurance available to ginner as a protection against losses from fires occurring in seed cotton, gin processing fires and fires in baled cotton.

The number of processing fires for the three years combined greatly exceeded the number of seed cotton and baled cotton fires in each of the three states ranging from 58 percent of the total in California to 78 percent in New Mexico (Figure 1). The second most prevalent type was seed cotton fires, ranging from 17 percent of the total fires in New Mexico to 32 percent in California. The proportion of baled cotton fires to total fires was greatest in Arizona amounting to 12 percent.

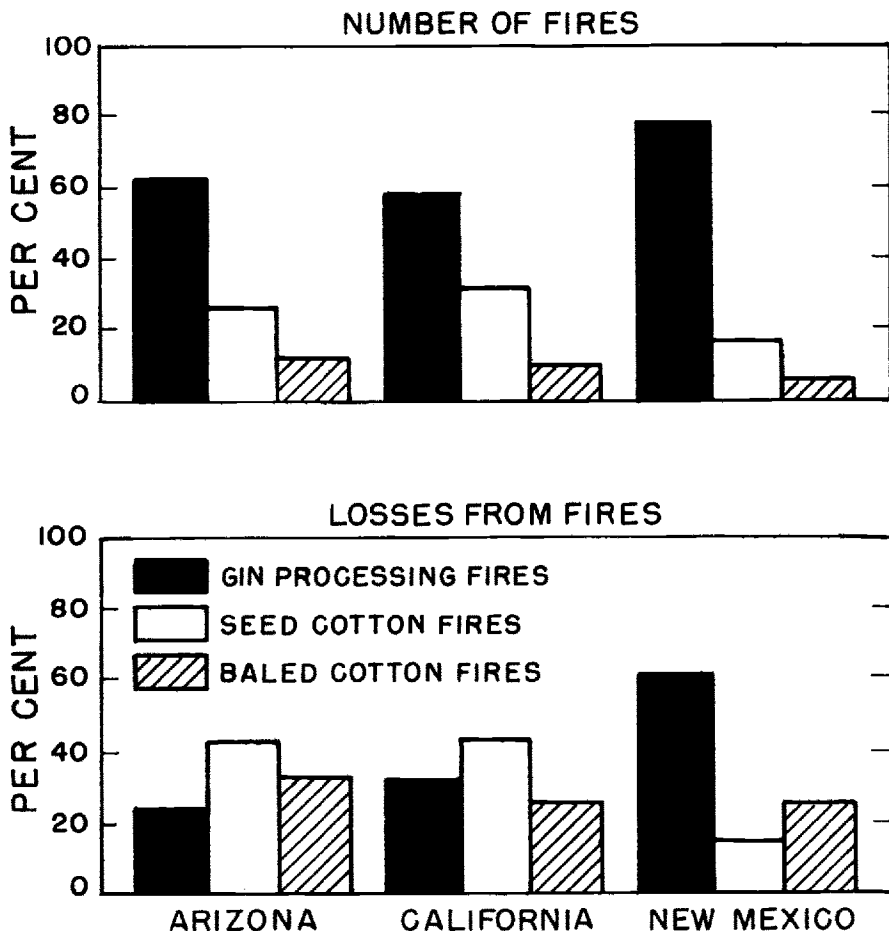


Figure 1. Numbers of and Losses from Fires at Sample Gins by Major Type of Fire and State, Three Seasons, 1956-57 to 1958-59.

Losses from all fires at the sample gins for the three seasons totaled \$333,235 in Arizona, \$240,586 in California and \$115,746 in New Mexico (Table 2).

Table 2. Losses from Fires at Sample Gins by Major Type of Fire and Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Type of Fire			Total
	Gin Processing	Seed Cotton	Baled Cotton	
	(dollar losses)			
Arizona:				
1956-57	36,806	47,342	58,991	143,139
1957-58	20,382	56,644	18,035	95,061
1958-59	23,213	38,985	32,837	95,035
Total—three seasons	80,401	142,971	109,863	333,235
California:				
1956-57	22,486	31,467	16,843	70,796
1957-58	24,677	32,815	22,626	80,118
1958-59	30,705	37,590	21,377	89,672
Total—three seasons	77,868	101,872	60,846	240,586
New Mexico:				
1956-57	14,150	3,549	11,590	29,289
1957-58	5,812	4,883	8,905	19,600
1958-59	51,566	6,409	8,882	66,857
Total—three seasons	71,528	14,841	29,377	115,746

The average seasonal losses per gin in Arizona declined from \$1,645 for 1956-57 to \$1,118 for 1958-59, averaging \$1,287 for the three years. In contrast, seasonal losses in California increased from about \$853 for 1956-57 to \$1,019 for 1958-59 with an overall average of \$929. Average losses in New Mexico dropped from \$623 for 1956-57 to \$408 for the following year, but jumped to \$1,393 for the final season as a result of the almost complete destruction of one gin plant. This gave a three-year average loss figure of \$809 per gin for New Mexico.

Losses from all types of fires averaged \$159 per fire in Arizona, \$132 in California and \$173 in New Mexico. Losses per 1,000 bales ginned averaged \$208, \$148 and \$186 in Arizona, California and New Mexico, respectively.

The relative importance of the several types of fires varied among the three states. Baled cotton fires were responsible for from 25 percent to 33 percent of the total losses suffered during the three-year period in each of the three states (Figure 1). Seed cotton fires accounted for nearly 43 percent of the total losses in both Arizona and California but only 13 percent in New Mexico. In contrast, losses incurred as the result of gin processing fires ranged from about 24 percent of the total losses in Arizona to 62 percent in New Mexico.

GIN PROCESSING FIRES

Locations

Most gin processing fires originated in the overhead cleaners and the gin stands. From 50 percent to as high as 96 percent of all pro-

cessing fires were first detected in one of these two locations (Table 3). Most of the remaining processing fires which could be identified by point of origin occurred in either the driers, burr extractors, or lint cleaners.

Table 3. Gin Processing Fires by Location and Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Specified Locations of Processing Fires					
	Drier	Overhead Cleaners	Burr Extractor	Gin Stands	Lint Cleaners	Other ⁴
(percent of fires)						
Arizona ¹						
1956-57	8	48	7	22	3	12
1957-58	15	32	20	18	5	10
1958-59	12	34	18	22	9	5
California ²						
1956-57	13	26	11	26	12	12
1957-58	17	32	6	27	8	10
1958-59	15	44	7	16	9	9
New Mexico ³						
1956-57	0	77	0	19	1	3
1957-58	0	87	0	9	0	4
1958-59	1	63	1	23	2	10

¹Based on 424 fires in 1956, 239 in 1957 and 323 in 1958; location of other fires not specified.

²Based on 186 fires in 1956, 250 in 1957 and 204 in 1958; location of other fires not specified.

³Based on 213 fires in 1956, 141 in 1957 and 165 in 1958; location of other fires not specified.

⁴Includes separator, conveyor, condenser and press box.

Causes

Matches and smoking were reported to be the most common causes of processing fires in the sample gins. They were thought to have caused from 69 to 85 percent of all processing fires occurring annually within these three states. Sulfur tipped kitchen matches often find their way into the seed cotton during the picking operation. Farmers, contractors and ginners have long been aware of this hazard and have encouraged pickers and crew members to use safety matches. In spite of this kitchen matches still turn up in seed cotton on trailers and at various points throughout the gins.

With the trend toward mechanical picking in this three-state area one would expect the relative importance of matches as a cause of processing fires to diminish. This, however, was not the case during the period of this study.

Friction in the roll box, while reported as the second most common cause of gin processing fires, was of relatively minor importance compared with matches.

Losses from Processing Fires

In terms of dollar losses, individual gin processing fires were comparatively small. On the basis of a three-season average, 48 percent of these fires in California incurred losses of less than \$50 each.

This was true for 58 percent of the processing fires occurring in Arizona and 71 percent of those occurring in the New Mexico sample gins. Only 5 percent of the processing fires reported in Arizona, 9 percent in California and 11 percent in New Mexico incurred losses in excess of \$150.00 each.

In Arizona and California most of the losses incurred in gin processing fires were sustained by the cotton products themselves, namely seed cotton, cotton lint and cottonseed. In Arizona 79 percent of the total losses from gin processing fires for the three-year period was to cotton products. This amounted to \$63,275 (Table 4). In California losses to cotton products from processing fires amounted to 67 percent.

Table 4. Itemized Losses from Gin Processing Fires at Sample Gins by Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Loss Item				Total
	Buildings and Machinery	Cotton Products	Carbon-Dioxide ¹	Labor	
			(dollars)		
Arizona:					
1956-57	255	29,273	312	6,966	36,806
1957-58	568	15,215	452	4,147	20,382
1958-59	125	18,787	165	4,136	23,213
Total—three seasons	948	63,275	929	15,249	80,401
California:					
1956-57	2,544	15,424	192	4,236	22,486
1957-58	305	19,245	280	4,847	24,677
1958-59	6,463	17,695	1,328	5,219	30,705
Total—three seasons	9,312	52,364	1,800	14,392	77,868
New Mexico:					
1956-57	1,600	10,743	24	1,783	14,150
1957-58	0	4,810	16	986	5,812
1958-59	40,942	8,999	128	1,496	51,565
Total—three seasons	42,542	24,552	168	4,265	71,527

¹Includes small expenditures for other fire extinguishing materials.

The loss item next in importance in Arizona and California was labor and downtime required to extinguish fires, clean up and repair damage. This amounted to 19 percent of the total.

Unusually heavy fire damage to buildings and machinery at one gin in New Mexico during the 1958-59 season made buildings and machinery the major loss item in that state for the three years studied. Losses to cotton products ranked second.

On a per bale basis processing fire losses amounted to about 5 cents in both Arizona and California and nearly 11½ cents in New Mexico.

Effectiveness of Fire Prevention and Control Devices

Two rather recent innovations in ginning equipment, the green boll trap and the magnet, were developed to reduce damage to gin-

ning machinery and to help prevent gin processing fires. The green boll trap was designed to remove immature bolls, rocks and other heavy objects from seed cotton shortly after it enters the gin suction pipe, and the magnet to remove tramp iron at one or more points in the gin line.

The green boll trap was the most commonly used of the two devices especially in Arizona and New Mexico. Magnets, found in only 22 percent of the sample gins, were confined principally to Arizona and California gins. Seventy-eight percent of those gins having neither of these devices were in California.

If friction and sparks created by heavy foreign objects accompanying seed cotton through the gin line are a major source of gin processing fires, gins equipped with one or both of these devices should have fewer fires on the average than gins with neither device. However, this study revealed that friction and sparks account for only a small fraction of the total processing fires. Consequently, there was little or no difference in the incidence of fires between the two groups of gins, those equipped with one or both devices and those with neither. Both groups of gins had an average of about .75 fires per 1,000 bales ginned or about one fire for every 1,333 bales. This amounted to about 4.3 fires per gin.

All of the sample gins had water hose, portable hand extinguishers and other basic fire-fighting equipment for extinguishing processing fires. In addition, 7 percent were equipped with carbon dioxide (CO₂) fire fighting systems. Losses in gins with CO₂ averaged \$70 per processing fire compared to \$80 per fire for those gins not so equipped. On a per gin basis, processing losses averaged \$235 for the CO₂ group compared to \$360 per gin for those in the other group. These limited data tend to indicate that CO₂ systems are effective in reducing losses from gin processing fires.

Effect of Rate of Ginning on Incidence of Fires

Gin managers, ginners and others closely associated with the ginning industry have expressed the belief that the incidence of processing fires increases as the rate of ginning increases. They contend that under pressure of heavy ginnings some ginners and gin crews become less attentive in following the normally prescribed fire preventative and machinery maintenance practices. However, this study failed to support this general belief. In Arizona and California, the number of processing fires per 1,000 bales ginned declined steadily as the rate of ginning increased from a few bales per week up to 1,400 or 1,500 bales (Figure 2). For the three ginning seasons studied, the average number of processing fires per 1,000 bales ginned for Arizona and California gins combined was 1.6 when less than 100 bales were ginned per week at either end of the season. When the ginning rate climbed to as high as 1,400 to 1,499 bales per week, this average dropped to a low of about 0.1 fires per 1,000 bales ginned. In New Mexico there was no consistent tendency for the number of fires to either increase or decrease as the rate of ginning increased.

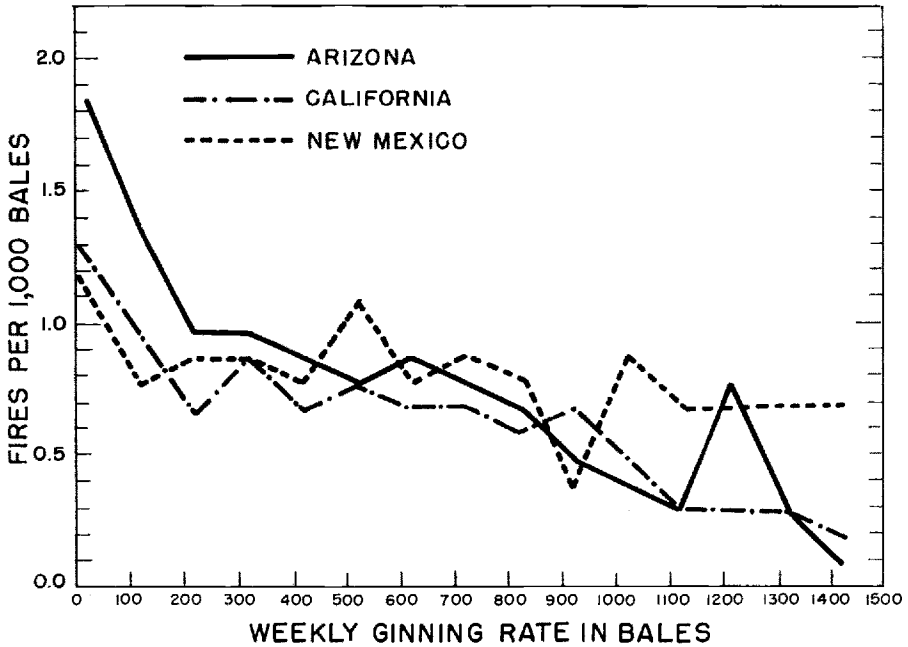


Figure 2. Number of Gin Processing Fires per 1,000 Bales Ginned by Weekly Ginning Rate, Western Area, Average Three Seasons, 1956-57 to 1958-59.

Effect of Method of Harvest on Incidence and Costs of Processing Fires

On an average, Arizona ginners processed 7.6 times as many bales of machine-picked cotton per fire as that picked by hand (Table 5). For California, this factor was 5.6 and for New Mexico 1.6 favoring machine picking.

Table 5. Number of Bales Ginned per Processing Fire and Losses per 1,000 Bales Ginned by Method of Harvest and Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Bales Ginned per Fire		Losses per 1,000 Bales	
	Machine (number)	Hand	Machine (dollars)	Hand
Arizona:				
1956-57	5,322	773	13	97
1957-58	5,577	700	13	85
1958-59	5,609	698	9	83
Average—three seasons	5,513	729	11	89
California:				
1956-57	5,152	674	11	87
1957-58	3,265	845	20	77
1958-59	4,558	726	23	110
Average—three seasons	4,170	750	18	91
New Mexico:				
1956-57	1,749	971	20	75
1957-58	2,676	1,544	11	21
1958-59	1,794	1,199	911	48
Average—three seasons	1,925	1,175	418	50

On an actual cost basis, processing fire losses per 1,000 bales for hand-picked cotton averaged \$89 in Arizona and \$91 in California as compared to \$11 and 18, respectively, for machine-picked cotton. Machine-picked cotton in New Mexico would have also shown a similar cost advantage for the three seasons had it not been for one major processing fire in the 1958-59 season involving machine-picked cotton which resulted in almost complete destruction of one gin plant.

SEED COTTON FIRES

Locations

Seed cotton fires originate in mechanical picker baskets, in seed cotton piled in the field, during the movement of seed cotton from the field to the gin and in trailers on the gin yard while awaiting ginning. Roughly 65, 70 and 90 percent of these fires in Arizona, California and New Mexico, respectively, occurred either in the field or in trailers en route to the gin. Almost all of the remainder of these fires occurred in trailers on the gin yard awaiting ginning.

Causes

Smoking and matches were the chief known causes of seed cotton fires. Carelessness of smokers accounted for 89 percent of all such fires in New Mexico and almost 60 percent of those occurring in Arizona and California. Exhaust sparks from pickers, tractors and other vehicles was the next most commonly reported cause of seed cotton fires.

Losses from Seed Cotton Fires

Individual seed cotton fires may incur losses of thousands of dollars when a seed cotton house or a number of loaded trailers are destroyed. Fortunately, occurrences of fires of this magnitude are exceptional. In this study nearly 50 percent of the seed cotton fires in Arizona and about 65 percent of those in California and New Mexico incurred losses of less than \$100 each. About 14 percent of the combined number of fires reported in the three states for the study exceeded \$500 in magnitude.

Effect of Harvesting Method on Incidence of Fires

In Arizona there was no consistent relationship between method of harvest and number of, or losses from, fires in seed cotton. Hand-picked cotton showed a slight advantage over machine-picked in number of bales ginned per fire (Table 6). However, losses per bale ginned in hand-picked cotton averaged \$110 per 1,000 bales compared to \$88 per 1,000 bales of machine-picked cotton.

Table 6. Number of Bales Ginned per Seed Cotton Fire and Losses per 1,000 Bales Ginned by Method of Harvest and Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Bales Ginned per Fire		Losses per 1,000 Bales	
	Machine	Hand	Machine	Hand
	(number)		(dollars)	
Arizona:				
1956-57	1,821	1,973	122	140
1957-58	2,667	8,065	86	43
1958-59	3,546	1,988	45	139
Average—three seasons	2,404	2,591	88	110
California:				
1956-57	2,961	2,054	46	82
1957-58	4,156	3,053	50	48
1958-59	3,923	2,413	33	105
Average—three seasons	3,647	2,644	43	75
New Mexico:				
1956-57	12,500	5,882	2	12
1957-58	7,692	8,333	60	19
1958-59	4,000	4,167	23	31
Average—three seasons	5,882	5,556	23	21

In California and New Mexico the advantage was in favor of machine-picked cotton in terms of bales ginned per fire. Losses per bale ginned were, on an average, significantly less in machine-picked cotton for California but slightly higher than in hand-picked cotton for New Mexico.

BALED COTTON FIRES

Causes

It is often difficult to isolate the causes of fires occurring in baled cotton on gin baleyards. This type of fire occurs frequently at night for no apparent reason. In this study, although an occasional fire in baled cotton was attributed to careless smokers or exhaust sparks from passing vehicles, causes of most of the fires were unknown.

Losses from Baled Cotton Fires

An average of only 13 percent of all baleyard fires at the sample gins in Arizona and California incurred losses of \$500 or more while 58 percent caused losses ranging between \$100 and \$200 per fire (Table 7).

Table 7. Losses from Baled Cotton Fires by Amount of Loss and Ginning Season, Western Area, 1956-57 to 1958-59.

State and Ginning Season	Amount of Loss, in Dollars				
	Less than 50.00	50.00- 99.99	100.00- 199.99	200.00- 499.99	500.00 and more
	(percent of fires)				
Arizona:					
1956-57	7	2	60	14	17
1957-58	7	11	57	11	14
1958-59	7	6	58	21	8
Average—three seasons	7	6	58	16	13
California:					
1956-57	6	1	63	18	12
1957-58	14	4	40	25	17
1958-59	9	1	70	11	9
Average—three seasons	9	2	58	18	13
New Mexico:					
1956-57	0	0	25	12	63
1957-58	0	0	14	0	86
1958-59	20	0	40	13	27
Average—three seasons	10	0	30	10	50

In contrast, during the first two years of the study 63 and 86 percent, respectively, of all baleyard fires in New Mexico incurred losses of \$500 or more. For the final season of 1958-59, however, only 27 percent of the baleyard fires in New Mexico were of this magnitude and 60 percent were under \$200.