

TABLE 29

MULTIPLE REGRESSIONS OF RESULTS OF PULMONARY FUNCTION TESTS WITH SMOKING AND GRAIN HANDLING HISTORY, HEIGHT AND AGE OF GRAIN WORKERS AND CONTROLS. RELATIVE CONTRIBUTIONS (b) OF THE INDEPENDENT VARIABLES AND SIGNIFICANCE OF THE CONTRIBUTION(p)

TEST	GRAIN HANDLING		SMOKING		PREVIOUS SMOKING		AGE		HEIGHT	
	b	p	b	p	b	p	b	p	b	p
FEV <sub>1</sub>	-172	.0002	-248	.0000	-119	.03	-41	.0000	103	.0000
FVC	-139	.009	-137	.04	- 55	NS	-33	.0000	140	.0000
FEV <sub>1</sub> %FVC	- 1.3	.04	- 3.2	.0001	- 2.0	.025	- 3.3	.0000	- .13	NS
MMF	- 24.1	.0000	- 29.5	.0001	- 13	NS	- 4.0	.0000	4.4	.0000
Vmax <sup>50</sup>	- 7.2	.0000	- 35	.02	- .10	NS	- 0.07	.0000	.06	.004
Vmax <sup>75</sup>	- .25	.0000	- .27	.0000	- .13	.03	- .04	.0000	.03	.003
CV	.62	NS	1.4	.01	1.4	.01	.30	.0000	.06	NS
ΔN <sub>2</sub> /L	.23	.02	.79	.0000	.25	.05	.05	.0000	- .06	.0005
D <sub>L</sub> CO	3.13	.0000	- 4.58	.0000	- 1.77	.02	- .23	.0000	.88	.0000

TABLE 30

## Prevalence of Abnormal Lung Functions

		ALL			SMOKERS			EX-SMOKERS			NONSMOKERS			p <sup>2</sup>	p <sup>3</sup>			
		N	%	p <sup>1</sup>	N	%	p <sup>1</sup>	N	%	p <sup>1</sup>	N	%	p <sup>1</sup>					
FEV <sub>1</sub> /FVC % <70	G (310)	51	16	<.001	(153)	28	18	<.05	(92)	17	18	NS	(65)	6	9	NS	<.1	NS
	C (237)	16	7		(106)	9	8		(68)	6	9		(63)	1	2		<.1	NS
MMF<1.65SD Of Predicted	G (310)	60	19	<.001	(153)	33	22	<.005	(92)	23	25	<.001	(65)	4	6	<.05	<.01	NS
	C (237)	12	5		(106)	9	8		(68)	3	4		(63)	0	0		<.05	<.05
V <sub>max50</sub> <1.65SD of Predicted	G (310)	130	42	<.001	(153)	68	44	<.001	(92)	43	47	<.05	(65)	19	29	<.01	<.05	NS
	C (235)	46	19		(106)	21	20		(67)	19	25		(62)	6	3		<.1	NS
V <sub>max75</sub> <1.65SD of Predicted	G (310)	153	49	<.001	(153)	83	54	<.001	(92)	51	55	<.05	(65)	19	29	NS	<.001	NS
	C (235)	68	29		(106)	31	29		(68)	25	37		(63)	12	19		NS	NS
CV<1.65SD	G (296)	43	15	<.001	(147)	20	14	NS	(87)	17	20	<.01	(62)	6	10	NS	NS	NS
	C (225)	12	5		(102)	7	7		(65)	3	5		(58)	2	3		NS	NS
ΔN <sub>2</sub> /L>1.65SD of Predicted	G (299)	101	34	<.01	(148)	67	45	NS	(87)	24	28	NS	(64)	10	16	NS	<.001	<.01
	C (226)	51	23		(103)	35	34		(65)	12	18		(58)	4	7		<.001	<.05
FVC <80% of Predicted	G (310)	17	5	<.1	(153)	10	7	NS	(92)	5	5	NS	(65)	2	3	<.05	NS	NS
	C (237)	6	3		(106)	4	4		(68)	2	3		(63)	0	0		NS	NS
D <sub>L</sub> CO<80 % of Predicted	G (283)	22	8	<.005	(140)	14	10	<.01	(89)	6	7	NS	(54)	2	4	NS	NS	NS
	C (203)	33	16		(88)	20	23		(58)	9	16		(57)	4	7		<.05	NS

( ) Total tested with each test on each category. P<sup>1</sup> Grain vs. Control Workers.

P<sup>2</sup> Smokers vs. Nonsmokers. P<sup>3</sup> Smokers vs. Ex-smokers. Values ≤.05 are considered not significant.

TABLE 31

**RATIOS\* OF THE EFFECT OF SMOKING TO THE EFFECT  
OF GRAIN HANDLING FROM MULTIPLE REGRESSION ANALYSIS**

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FEV <sub>1</sub>	1.44
FVC	.99
FEV <sub>1</sub> /FVC	2.46
MMF	1.22
Vmax <sub>50</sub>	.49
Vmax <sub>75</sub>	1.08
D <sub>L</sub> CO	1.46
CV	2.26
ΔN <sub>2</sub> /L	3.43

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\*Ratio of the regression coefficient for smoking and grain handling from the multiple regression analysis that included ex-smoking, age and height as the other independent variables.

**TABLE 32**  
**PULMONARY FUNCTIONS ON GRAIN WORKERS BY JOB CATEGORIES**

	(06) N=94		(02, 03, 04) N=90		(05) N=41		(07) N=31		(09) N=29		(01) N=20	
	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD
FEV <sub>1</sub> ml	4017	763.5	3393	960.8	3631	726.0	3734	835.6	3703	851.4	3328	596.8
% Predicted	99.5	12.7	99.7	19.7	97.8	16.4	98.2	15.7	96.5	15.6	94.3	18.8
FVC ml	5054	783.4	5081	1010.7	4663	816.0	4714	912.0	4714	778.6	4324	514.5
% Predicted	101.6	11.9	103.1	16.6	100.3	15.1	99.7	13.9	99.8	9.6	97.6	14.2
FEV <sub>1</sub> /FVC %	78.6	8.06	77.6	9.11	76.9	9.99	78.2	7.76	75.8	9.59	76.2	9.59
MMF <sub>1</sub> /min.	299.6	86.3	277.8	87.8	206.9	83.7	209.8	76.7	216.4	98.4	190.0	74.4
% Predicted	76.1	25.3	76.3	27.9	73.6	28.2	73.3	24.2	74.8	29.9	70.7	28.3
V <sub>max</sub> <sup>50</sup> l/sec	4.17	1.60	4.01	1.60	3.90	1.56	3.58	1.44	4.02	1.67	3.65	1.38
% Predicted	67.2	25.6	65.2	26.1	64.3	25.8	59.5	23.8	64.5	26.3	61.6	23.8
V <sub>max</sub> <sup>75</sup> l/sec	1.58	.85	1.48	.78	1.23	.52	1.20	.67	1.37	.70	1.16	.57
% Predicted	48.2	25.4	45.6	22.3	40.1	17.6	36.8	19.7	42.7	20.6	39.5	20.3
CV %	16.3	6.08	16.1	6.55	18.5	6.76	18.6	6.82	17.9	6.12	19.2	4.93
% Predicted	116.4	35.9	119.9	40.9	114.8	55.8	119.4	32.6	109.6	36.7	114.1	26.0
ΔW <sub>2</sub> /l	1.53	.97	1.69	1.50	1.96	1.80	1.65	.98	2.05	1.90	2.35	1.40
% Predicted	137.5	80.7	150.9	120.1	165.1	142.8	142.6	78.7	168.5	143.1	195.8	110.8
D <sub>L</sub> CO	35.5	5.8	34.1	6.2	32.2	5.4	32.1	8.2	33.9	6.7	31.5	6.0
% Predicted	113.6	18.9	111.0	19.7	104.0	16.1	105.6	25.4	104.5	20.6	101.8	15.8

TABLE 33

## PULMONARY FUNCTION ON GRAIN WORKERS BY LENGTH OF EMPLOYMENT

	5.5		5.6 - 10.5		10.6 - 15.5		15.6 - 20.5		20.6 - 25.5		25.6 - 30.5		30.6 - ...	
	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD	Mean	1 SD
FEV <sub>1</sub>	4340	794	3946	800	3585	842	3406	709	3520	747	3555	743	3267	587
% Predicted	103.2	12.7	100.2	18.1	94.1	15.4	92.3	17.8	94.6	15.0	98.3	18.6	95.0	13.6
FVC	5319	883	4905	860	4711	963	4565	808	4619	729	4767	746	4287	607
% Predicted	103.8	12.9	100.4	15.7	99.0	13.5	98.2	13.9	99.2	9.8	104.7	16.0	98.3	9.3
FEV <sub>1</sub> % FVC	81.1	6.33	79.5	9.0	75.0	8.6	73.6	9.8	75.1	9.6	73.5	7.9	75.0	8.3
MMF	261.8	79.9	238.0	80.2	193.1	84.5	172.9	70.4	198.1	88.8	180.2	78.7	172.7	76.1
% Predicted	84.7	23.1	80.1	25.7	67.3	27.6	62.4	25.7	70.8	28.4	65.9	27.3	66.2	29.3
V <sub>max</sub> 50	4.63	1.49	4.28	1.50	3.37	1.57	3.32	1.30	3.48	1.24	3.45	1.63	3.18	1.60
% Predicted	74.6	23.0	69.8	25.7	55.1	25.6	56.0	24.2	56.0	17.9	55.8	25.4	51.5	22.2
V <sub>max</sub> 50	1.85	.84	1.56	.71	1.04	.51	1.08	.43	1.09	.46	1.00	.41	1.01	.65
% Predicted	55.4	24.0	49.0	22.8	32.3	15.6	35.4	15.8	33.5	13.7	32.4	14.3	34.6	21.8
CV	14.15	6.03	16.02	6.17	18.5	6.82	18.9	5.08	19.5	4.62	21.9	6.23	21.3	2.60
% Predicted	121.2	50.2	118.4	38.1	114.0	34.6	111.0	31.7	112.2	25.3	117.1	34.9	107.7	16.7
Slope	1.27	.72	1.53	1.18	1.95	1.14	2.48	2.14	2.00	1.51	2.07	1.66	2.59	1.58
% Predicted	122.1	65.1	139.1	99.4	164.8	92.5	202.9	165.0	168.3	119.4	164.8	125.2	215.0	129.8
D <sub>L</sub> CO	36.5	6.17	33.5	6.27	31.5	7.23	32.5	5.37	34.7	4.70	31.7	6.88	31.3	4.94
% Predicted	119.2	19.0	109.0	18.7	98.7	20.0	103.9	18.6	109.4	12.5	100.0	20.0	99.5	14.2

TABLES 34/35

## PREVALENCE OF ERYTHEMA REACTION 5 mm OR GREATER

	Grain Workers n=305			Controls n=235			MDN Workers n=103			
	N	%	p <sup>1</sup>	N	%	p <sup>2</sup>	N	%	p <sup>3</sup>	
<b>COMMON ALLERGENS</b> 1:20 w/v										
Ragweed	-	286	93.8	NS	214	91.1	NS	92	89.3	NS
	+	19	6.2		21	8.9		11	10.7	
Timothy Grass	-	281	92.1	.001	195	83.0	NS	90	87.4	NS
	+	24	7.9		40	17.0		13	12.6	
Feathers	-	294	96.4	.01	216	91.9	NS	94	91.3	.01
	+	11	3.6		19	8.1		9	8.7	
Oak	-	291	95.4	.005	210	89.4	NS	94	91.3	NS
	+	14	4.6		25	10.6		9	8.7	
Cat	-	293	96.1	.001	206	87.7	.05	97	94.2	NS
	+	12	3.9		29	12.3		6	5.8	
Rat	-	301	98.7	.005	222	94.5	NS	98	95.1	
	+	4	1.3		13	5.5		5	4.9	.01
To one or more										
<b>FUNGAL ANTIGENS</b> 1:20 w/v										
A. Fumigatus	-	292	95.7	NS	219	93.2	NS	94	91.3	.10
	+	13	4.3		16	6.8		9	8.7	
Penicillium	-	297	97.4	.1	221	94.0	NS	95	92.2	.05
	+	8	2.6		14	6.0		8	7.8	
Mucor Sp.	-	303	99.3	.05	228	97.0	NS	101	98.1	NS
	+	2	.7		7	3.0		2	1.9	
Cladosporium Sp.	-	297	97.4	NS	228	97.0	NS	101	98.1	NS
	+	8	2.6		7	3.0		2	1.9	
Alternaria Sp.	-	298	97.7	NS	231	98.3	NS	100	97.1	NS
	+	7	2.3		4	1.7		3	2.9	
Rust	-	302	99.0	NS	232	98.7	NS	102	99.0	NS
	+	3	1.0		3	1.3		1	1.0	
Smut	-	303	99.3	NS	230	97.9	NS	100	97.1	NS
	+	2	.7		5	2.1		3	2.9	
To one or more										

TABLE 34/35  
PREVALENCE OF WHEAL REACTION 3 mm OR GREATER

	Grain Workers n=305			Controls n=235			MDN Workers n=103			
	N	%	p <sup>1</sup>	N	%	p <sup>2</sup>	N	%	p <sup>3</sup>	
<b>COMMON ALLERGENS</b>										
Ragweed	-	286	93.8	NS	214	91.1	NS	94	91.3	NS
	+	19	6.2		21	8.9		9	8.7	
Timothy Grass	-	286	93.8		195	83.8		91	88.3	-.1
	+	19	6.2	.001	40	17.0		12	11.7	
Feathers	-	288	94.4	NS	216	91.9	NS	96	93.2	NS
	+	17	5.6		19	8.1		7	6.8	
	-	292	95.7	.01	211	89.8	.05	100	97.1	NS
	+	13	4.3		24	10.2		3	2.9	
	-	287	94.1	.1	211	89.8	NS	97	94.2	NS
	+	18	5.9		24	10.2		6	5.8	
	-	298	97.7	NS	224	95.3	NS	99	96.1	NS
	+	7	2.3		11	4.7		4	3.9	
To one or more		46	15.1	.05	51	21.7	.05	13	12.6	NS
<b>FUNGAL ANTIGENS</b>										
A. Fumigatus	-	288	94.4	NS	221	94.0	NS	96	93.2	NS
	+	17	5.6		14	6.0		7	6.8	
Penicillium	-	294	96.4	NS	221	94.0	NS	97	94.2	NS
	+	11	3.6		14	6.0		6	5.8	
Mucor Sp.	-	300	98.4	NS	228	97.0	NS	102	99.0	NS
	+	5	1.6		7	3.0		1	1.0	
Cladosporium Sp.	-	299	98.0	NS	229	97.4	NS	103	100.0	NS
	+	6	2.0		6	2.6		0		
Alternaria Sp.	-	295	96.7	NS	231	98.3	NS	100	97.1	NS
	+	10	3.3		4	1.7		3	2.9	
Rust	-	295	96.7	NS	232	98.7	NS	101	98.1	NS
	+	10	3.3		3	1.3		2	1.9	
Smut	-	297	97.4	NS	231	98.3	NS	101	98.1	NS
	+	8	2.6		4	1.7		2	1.9	
To one or more		35	11.5	NS	29	12.3	NS	12	11.7	NS

TABLE 34/35  
PREVALENCE OF ERYTHEMA REACTION 5 mm OR GREATER

	Grain Workers n=305			Controls n=235			MDN Workers n=103			
	N	%	p <sup>1</sup>	N	%	p <sup>2</sup>	N	%	p <sup>3</sup>	
<b>AIRBORNE DUST</b>										
	100,000 PNU/ml									
Wheat Durum	-	247	81.0	NS	199	84.7	.005	99	96.1	.001
	+	58	19.0		36	15.3		4	3.9	
Wheat Spring	-	280	91.8	NS	222	94.5	NS	101	98.1	.05
	+	25	8.2		13	5.5		2	1.9	
Barley	-	280	91.8	NS	216	91.9	NS	98	95.1	NS
	+	25	8.2		19	8.1		5	4.9	
Corn	-	286	93.8	NS	209	88.9	.05	100	97.1	NS
	+	19	6.2		26	11.1		3	2.9	
Rye	-	290	95.1	.005	208	88.5	.1	98	95.1	NS
	+	15	4.9		27	11.5		5	4.9	
Oats	-	286	93.8	.05	209	88.9	NS	96	93.2	NS
	+	19	6.2		26	11.1		7	6.8	
Sunflower	-	283	92.8	NS	215	91.5	NS	97	94.2	NS
	+	22	7.2		20	8.5		6	5.8	
To one or more										
<b>Settled Dust</b>										
	100,000 PNU/ml									
Dust I	-	276	90.8	NS	208	88.5	.1	98	95.1	NS
	+	28	9.2		27	11.5		5	4.9	
Dust II	-	271	89.1	NS	208	88.5	NS	96	93.2	NS
	+	33	10.9		27	11.5		7	6.8	
Dust III	-	281	92.7	.05	203	86.4	NS	94	91.3	NS
	+	22	7.3		32	13.6		9	8.7	
To one or more										

Significance of the difference between grain and city workers  $\chi^2$ .

Significance of the difference between city and MDN workers  $\chi^2$ .

Significance of the difference between grain and MDN workers  $\chi^2$ .



TABLE 34/35

## PREVALENCE OF WHEAL REACTION 3 mm OR GREATER

	Grain Workers n=305			Controls n=235			MDN Workers n=103			
	N	%	p <sup>1</sup>	N	%	p <sup>2</sup>	N	%	p <sup>3</sup>	
<b>AIRBORNE DUST</b>										
Wheat Durum	-	240	78.7	.01	205	87.2	.05	99	96.1	.001
	+	65	21.3		30	12.8		4	3.9	
Wheat Spring	-	276	90.5	.001	230	97.9	NS	102	99.0	.005
	+	29	9.5		5	2.1		1	1.0	
Barley	-	278	91.1	NS	221	94.0	NS	100	97.1	.05
	+	27	8.9		14	6.0		3	2.9	
Corn	-	284	93.1	NS	217	92.3	.05	101	98.1	.1
	+	21	6.9		18	7.7		2	1.9	
Rye	-	288	94.4	.1	213	90.6	NS	100	97.1	NS
	+	17	5.6		22	9.4		3	2.9	
Oats	-	287	94.1	NS	213	90.6	.05	100	97.1	NS
	+	18	5.9		22	9.4		3	2.9	
Sunflower	-	288	94.4	NS	216	91.9	.05	101	98.1	NS
	+	17	5.6		19	8.1		2	1.9	
To one or more		81	26.6	.1	48	20.4	.005	8	7.8	.001
<b>Settled Dust</b>										
Dust I	-	276	90.8	NS	211	89.8	.05	100	97.1	.05
	+	28	9.2		24	10.2		3	2.9	
Dust II	-	268	88.2	NS	213	90.6	NS	96	93.2	NS
	+	36	11.8		22	9.4		7	6.8	
Dust III	-	278	91.7	NS	211	89.8	.1	99	96.1	.1
	+	25	8.3		24	10.2		4	3.9	
To one or more		46	15.1	NS	36	15.3	.1	8	7.8	.05

Significance of the difference between grain and city workers  $\chi^2$ .Significance of the difference between city and MDN workers  $\chi^2$ .Significance of the difference between grain and MDN workers  $\chi^2$ .

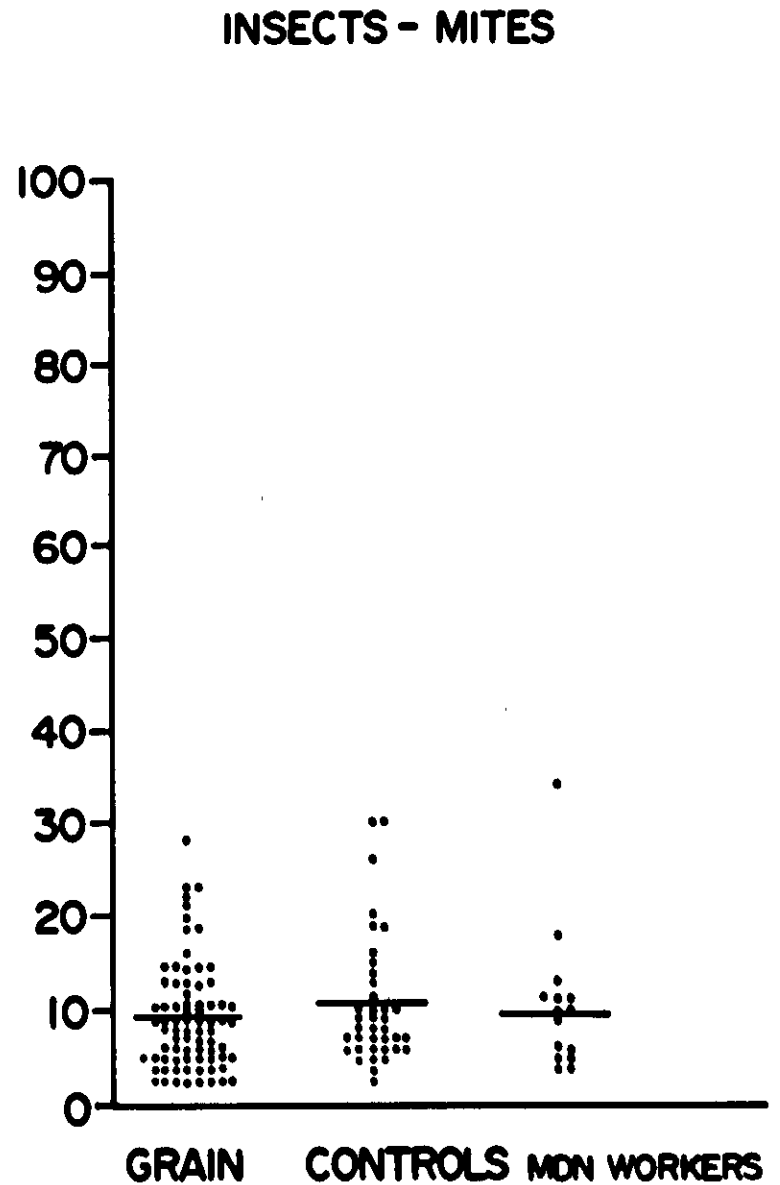
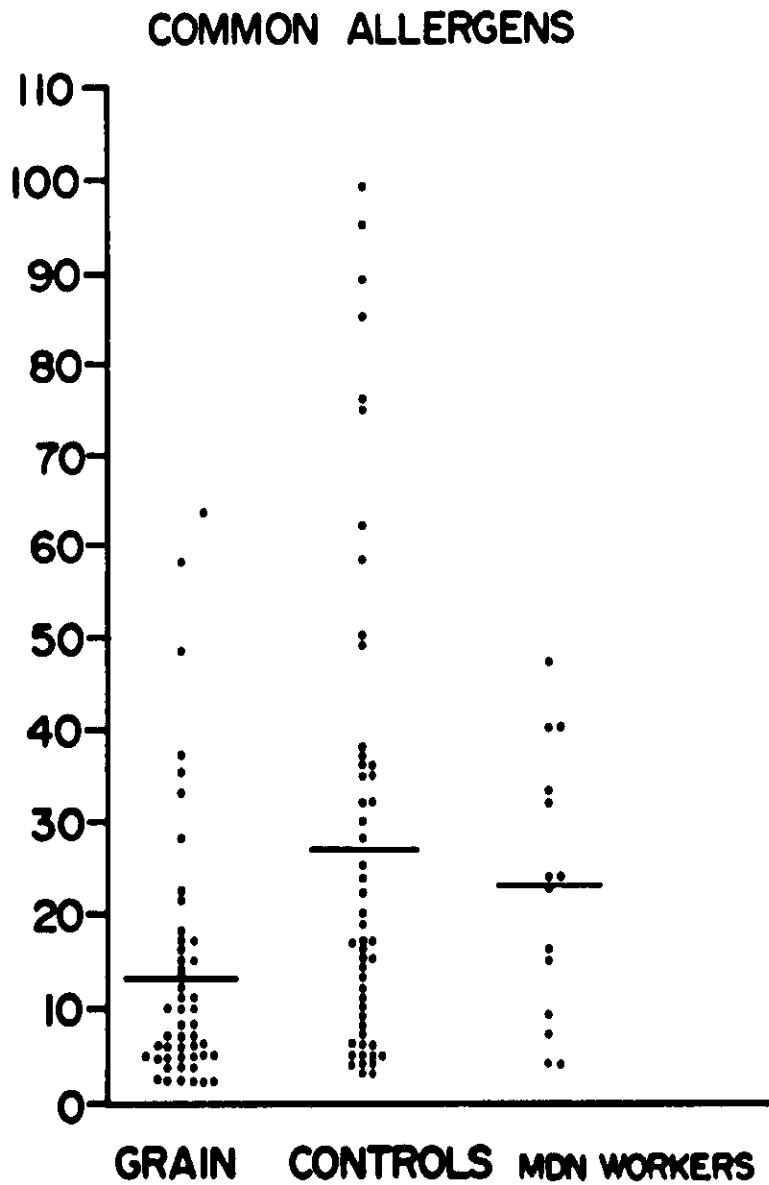
TABLE 34/35  
PREVALENCE OF ERYTHEMA REACTION 5 mm OR GREATER

	Grain Workers n=305			Controls n=235			MDN Workers n=103			
	N	%	p1	N	%	p2	N	%	p3	
<b>INSECTS-MITES</b>										
	10 mg/ml									
	-	264	86.6	NS	209	88.9	NS	90	87.4	NS
Mites Mixed	+	41	13.4		26	11.1		13	12.6	
	-	264	86.6	NS	211	89.8	NS	95	92.2	NS
Beetles Mixed	+	41	13.4		24	10.2		8	7.8	
	-	267	87.5	NS	209	88.9	NS	89	86.4	NS
Weevils	+	38	12.5		26	11.1		14	13.6	
To one or more										
<b>Grain</b>										
	100,000 PNU/ml									
	-	296	97.0	NS	229	97.4	NS	99	96.1	NS
Wheat Durum	+	9	3.0		6	2.6		4	3.9	
	-	300	98.4	.1	225	95.7	NS	100	97.1	NS
Wheat Spring	+	5	1.6		10	4.3		3	2.9	
	-	298	97.7	NS	227	96.6	NS	99	96.1	NS
Barley	+	7	2.3		8	3.4		4	3.9	
	-	296	97.0	NS	225	95.7	NS	99	96.1	NS
Corn	+	9	3.0		10	4.3		4	3.9	
	-	303	99.3	.005	223	94.9	NS	101	98.1	NS
Rye	+	2	.7		12	5.1		2	1.9	
	-	301	98.7	NS	228	97.0	NS	102	99.0	NS
Oats	+	4	1.3		7	3.0		1	1.0	
	-	296	97.0	NS	228	97.0	NS	98	95.1	NS
Sunflower	+	9	3.0		7	3.0		5	4.9	
	-	289	94.8	NS	219	93.2	NS	100	97.1	NS
Small Seeds	+	16	5.2		16	6.8		3	2.9	
	-	305	100.0	NS	234	99.6	NS	103	100.0	
Soybean	+	0			1	.4		0		
To one or more										

TABLE 34/35  
PREVALENCE OF WHEAL REACTION 3 mm OR GREATER

	Grain Workers n=305			Controls n=235			MDN Workers n=103			
	N	%	p <sup>1</sup>	N	%	p <sup>2</sup>	N	%	p <sup>3</sup>	
<b>INSECTS-MITES</b>	10 mg/ml									
	-	259	84.9	.05	213	90.6	NS	95	92.2	.1
<b>Mites Mixed</b>	+	45	15.1		22	9.4		8	7.8	
	-	260	85.2		215	91.5	NS	96	93.2	.05
<b>Beetles Mixed</b>	+	45	14.8	.05	20	8.5		7	6.8	
	-	266	87.2	NS	210	89.4	NS	93	90.3	NS
<b>Weevils</b>	+	39	12.8		25	10.6		10	9.7	
<b>To one or more</b>		69	22.6	.05	36	15.3	NS	15	14.6	.1
<b>Grain</b>										
	-	296	97.0	NS	231	98.3	NS	101	98.1	NS
<b>Wheat Durum</b>	+	9	3.0		4	1.7		2	1.9	
	-	299	98.0	NS	228	97.0	NS	102	99.0	NS
<b>Wheat Spring</b>	+	6	2.0		7	3.0		1	1.0	
	-	300	98.4	NS	228	97.0	.1	103	100.0	NS
<b>Barley</b>	+	5	1.6		7	3.0		0		
	-	297	97.4	NS	228	97.0	NS	101	98.1	NS
<b>Corn</b>	+	8	2.6		7	3.0		2	1.9	
	-	300	98.4	NS	227	96.6	NS	102	99.0	NS
<b>Rye</b>	+	5	1.6		8	3.4		1	1.0	
	-	300	98.4	NS	229	97.4	NS	103	100.0	NS
<b>Oats</b>	+	5	1.6		6	2.6		0		
	-	293	96.1	NS	228	97.0	NS	100	97.1	NS
<b>Sunflower</b>	+	12	3.9		7	3.0		3	2.9	
	-	285	93.4	NS	221	94.0	.05	102	99.0	.0?
<b>Small Seeds</b>	+	20	6.6		14	6.0		1	1.0	
	-	305	100.0		235	100.0		103	100.0	
<b>Soybean</b>	+	0			0			0		
<b>To one or more</b>		38	12.4	NS	28	11.9	.1	6	5.8	.1

# INDIVIDUAL SUM OF WHEAL REACTIONS



# INDIVIDUAL SUM OF WHEEL REACTIONS

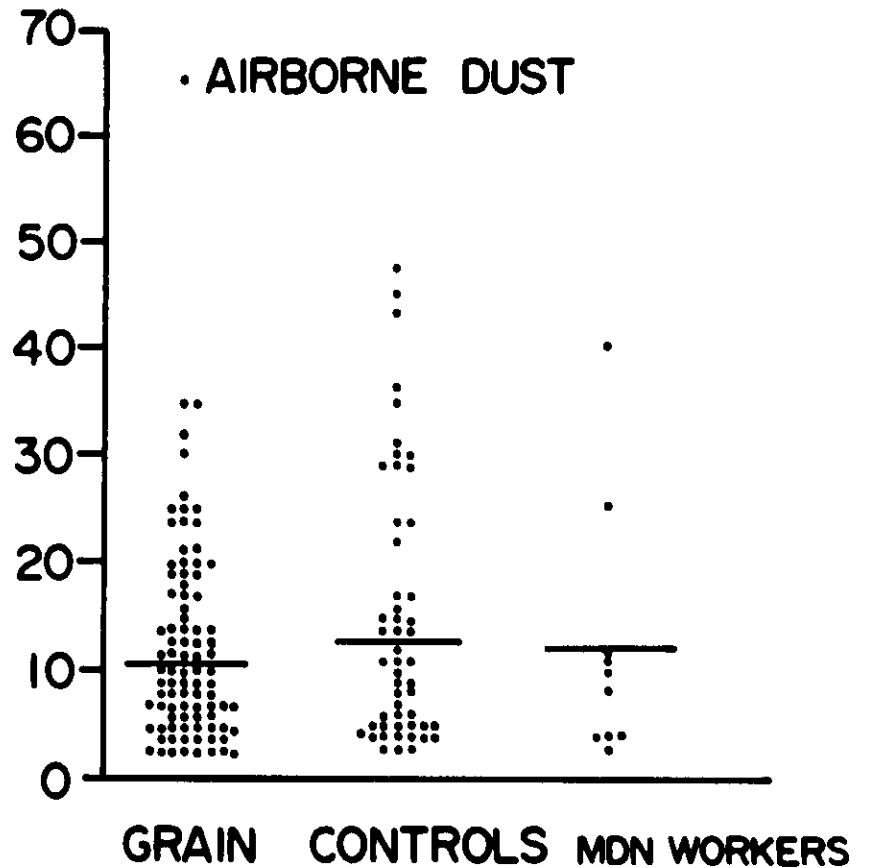
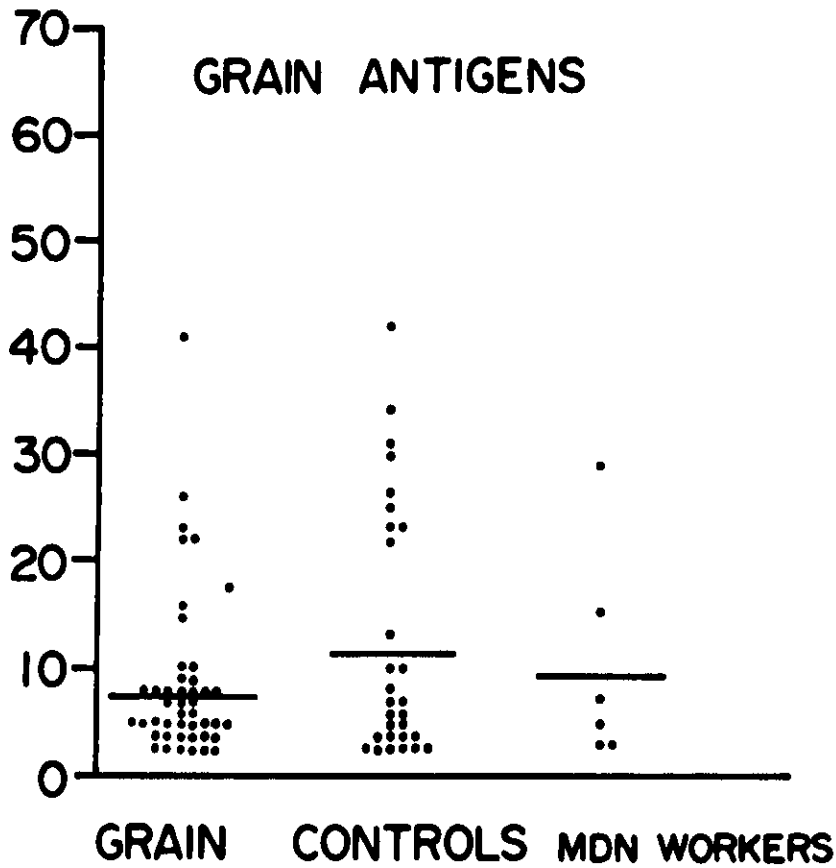


TABLE 37

PREVALENCE OF GRAIN DUST AND INSECT-MITE REACTIONS  
AMONG ATOPIC GRAIN OR CONTROL WORKERS

		Grain Dust Reactors		Insect-Mite Reactors	
		N	%	N	%
Atopic Grain Workers	(46)	37**	80	31**	67
Non-atopic	(259)	44	17	38	15
Atopic Controls	(51)	24**	47	13*	25
Non-atopic	(184)	24	13	23	12

\*P = .05 by  $\chi^2$  for the difference between atopic and non-atopic.

\*\*P = .001

TABLE 38. REGRESSION COEFFICIENTS (b) AND T RATIOS (t) OF THE SIGNIFICANT\* RELATIONS BETWEEN ACUTE AND CHRONIC SYMPTOMS AND LUNG FUNCTION ADJUSTED FOR AGE, HEIGHT, SMOKING HABIT  
MULTIPLE REGRESSION ANALYSIS†

		FEV <sub>1</sub> FVC	FEV <sub>1</sub>	FVC	MMF	V <sub>MAX</sub> 50	V <sub>MAX</sub> 75	CV	ΔN <sub>2</sub> /L	DL
<b>GRAIN WORKERS df (n-1) =</b>		<b>310</b>	<b>310</b>	<b>310</b>	<b>310</b>	<b>310</b>	<b>310</b>	<b>296</b>	<b>299</b>	<b>283</b>
Chronic Bronchitis	b									
	t									
Cough First Thing in A.M.	b	-2.51			-16.70					
	t	-2.7			-2.0					
Phlegm First Thing in A.M.	b									
	t									
Dyspnea on Exertion	b	-1.85	-178.8	-130.0						
	t	-2.0	-2.7	-1.7						
Wheezing at Night	b									
	t									
Cough on Exposure	b	-3.07	-157.8		-19.11	-0.487	- .140			
	t	-3.4	-2.4		-2.4	-3.0	-2.2			
Occupational Asthma I	b	-1.63	-130.8			-0.305	-0.167		0.272	
	t	-1.8	-2.0			-1.9	-2.7		+1.9	
Dyspnea on Exposure	b		-144.9			-0.264	-0.109			
	t		-2.3			-1.7	-1.8			
Occupational Asthma II	b	-1.79	-116.5			-0.275	-0.120		0.281	
	t	-2.0	-1.8			-1.7	-1.9		+2.0	
Occupational Asthma IV	b		-172.9	-164.7					0.331	
	t		-2.2	-1.9					+1.9	
Grain Fever	b									
	t									
Chest Illness	b									
	t									
<b>CONTROLS df (n-1) =</b>		<b>237</b>	<b>237</b>	<b>237</b>	<b>237</b>	<b>235</b>	<b>235</b>	<b>225</b>	<b>226</b>	<b>203</b>
Chronic Bronchitis	b	-3.50		-25.7					0.550	
	t	-3.10		-2.2					+3.53	
Dyspnea on Exertion	b	-1.99							0.275	
	t	-1.99							+2.02	
Wheezing at Night	b	-3.72			-0.631					
	t	-2.63			-2.10					
Occupational Asthma II	b									
	t									

\*P < .05 when t > 1.66 using one tail area of t distribution and > 200 degrees of freedom  
(P < .05 when t > 1.98 using two tail)

†Multiple regression analysis using lung function test value as the dependent variable and symptom, age, height, smoking and nonsmoking as independent variables.

TABLE 39

PREVALENCE OF ABNORMAL LUNG FUNCTION IN  
GRAIN WORKERS WITH AND WITHOUT SYMPTOMS

Abnormal Function	Cough on Exposure					Wheezing on Exposure					Dyspnea on Exposure					Grain Fever				p*
	Yes		No		P*	Yes		No		P*	Yes		No		P*	Yes		No		
	#	%	#	%		#	%	#	%		#	%	#	%		#	%	#	%	
	<u>N=200</u>		<u>N=100</u>			<u>N=183</u>		<u>N=127</u>			<u>N=151</u>		<u>N=159</u>			<u>N=99</u>		<u>N=211</u>		
FEV <sub>1</sub> /FVC <70% (310)	41	20	10	9	<.01	37	20	14	11	<.05	31	21	20	13	<.1	20	20	31	15	NS
FVC <80% (310)	12	6	5	5	NS	13	7	4	3	NS	14	9	3	2	<.005	5	5	12	6	NS
MMP <1.65 SD (310)	47	29	13	12	<.05	45	25	15	12	<.01	37	25	23	14	<.05	22	22	38	18	NS
$\dot{V}_{MAX50}$ <1.65 SD (310)	92	46	38	35	<.1	89	49	41	32	<.005	76	50	54	34	<.005	44	44	86	41	NS
$\dot{V}_{MAX75}$ <1.65 SD (296)	105	53	48	44	NS	107	58	46	36	<.001	89	59	64	40	<.005	53	54	100	47	NS
	<u>N=200</u>		<u>N=96</u>			<u>N=183</u>		<u>N=113</u>			<u>N=151</u>		<u>N=145</u>			<u>N=99</u>		<u>N=197</u>		
CV <1.65 SD (296)	30	15	13	14	NS	32	17	11	11	NS	28	19	15	10	<.05	13	13	30	15	NS
	<u>N=200</u>		<u>N=96</u>			<u>N=183</u>		<u>N=110</u>			<u>N=151</u>		<u>N=148</u>			<u>N=99</u>		<u>N=209</u>		
$\Delta N_2/L$ <1.65 SD (299)	77	39	23	23	<.01	67	37	33	28	NS	60	40	40	27	<.05	35	35	65	33	NS
	<u>N=184</u>		<u>N=99</u>			<u>N=169</u>		<u>N=114</u>			<u>N=143</u>		<u>N=140</u>			<u>N=92</u>		<u>N=191</u>		
D <sub>L</sub> CO <80% (283)	19	10	3	3	<.05	17	10	5	4	<.1	14	10	8	6	NS	10	11	12	6	NS



TABLE 39 (CONT'D.)

Abnormal Function	Chronic Bronchitis					Cough First Thing in A.M.					Wheezing at Night					Dyspnea on Exertion				
	Yes		No		P*	Yes		No		P*	Yes		No		P*	Yes		No		P*
	#	%	#	%		#	%	#	%		#	%	#	%		#	%	#	%	
FEV <sub>1</sub> /FVC <70% (310)	31	23	20	11	<.01	25	23	26	13	<.05	9	15	42	17	NS	30	25	21	11	<.001
FVC <80% (310)	5	4	12	7	NS	6	6	11	5	NS	5	8	12	5	NS	12	10	5	3	<.005
MHF <1.65 SD (310)	36	27	24	14	<.005	31	28	29	14	<.005	13	21	47	19	NS	33	28	27	14	<.005
V <sub>Max</sub> <sup>50</sup> <1.65 SD (310)	68	50	62	35	<.01	49	45	81	40	NS	32	52	98	39	<.1	56	47	74	39	NS
V <sub>MAX</sub> <sup>75</sup> <1.65 SD (296)	75	36	78	45	<.1	56	51	97	48	NS	36	59	117	47	<.1	66	56	87	45	<.1
	<u>N=135</u>		<u>N=161</u>			<u>N=109</u>		<u>N=187</u>			<u>N=61</u>		<u>N=235</u>			<u>N=118</u>		<u>N=178</u>		
CV <1.65 SD (296)	18	13	25	16	NS	15	14	28	15	NS	12	20	31	13	NS	14	12	29	16	NS
	<u>N=135</u>		<u>N=164</u>			<u>N=109</u>		<u>N=190</u>			<u>N=61</u>		<u>N=238</u>			<u>N=118</u>		<u>N=181</u>		
ΔN <sub>2</sub> /L <1.65 SD (299)	48	36	52	32	NS	46	42	54	28	<.05	22	36	78	33	NS	47	40	53	29	NS
	<u>N=125</u>		<u>N=158</u>			<u>N=105</u>		<u>N=178</u>			<u>N=57</u>		<u>N=226</u>			<u>N=108</u>		<u>N=175</u>		
D <sub>L</sub> CO 80% (283)	13	10	9	6	NS	13	12	9	6	.05	6	11	17	7	NS	15	14	7	4	.005

\*Significance of difference in prevalence of abnormal lung functions in workers with and without symptoms.  
NS = Not significant.

TABLE 40a

REGRESSION COEFFICIENTS (b) AND T RATIOS (t) FOR THE SIGNIFICANT\*  
RELATIONS OF SKIN REACTIVITY TO COMMON OR SPECIFIC ANTIGENS AND PULMONARY  
FUNCTION ADJUSTED FOR AGE, HEIGHT, SMOKING HABIT USING MULTIPLE REGRESSION ANALYSIS†  
(GRAIN WORKERS)

		Total Wheal CAA††	Total Wheal Grain††	Durum Wheat	Barley	CAA**	Airborne Dust	Grain	Insects Mites	Fungi	Settled Dust
FEV <sub>1</sub> /	b	-.064	-.049						-1.83	- 3.77	- 2.44
FVC	t	-1.95	-1.73						-1.73	- 2.74	- 1.98
FEV <sub>1</sub>	b	-6.08	-5.24	-183.7		-170.3	-161.6			-268.5	-240.5
	t	2.61	-2.57	- 2.40		- 1.92	- 2.25			2.71	2.73
FVC	t	-1.75	-1.77	- 1.94		- 1.76	- 1.96				
MMP	b	-.67	-.549			- 17.9	- 14.49			- 30.1	- 23.3
	t	-2.39	-2.26			- 1.69	- 1.69			- 2.55	- 2.21
V <sub>MAX</sub> 50	b	-.014	-.010	-.404			-.364			-.703	-.412
	t	-2.49	-2.10	- 2.16			- 2.08			- 2.92	- 1.91
V <sub>MAX</sub> 75	b	-.005	-.004	- 1.89			- 1.71			-.213	-.178
	t	-2.23	-2.26	- 2.59			- 2.49			- 2.23	- 2.09
ΔN <sub>2</sub> /L	b										
	t										
DL	b									- 1.87	- 1.57
	t									- 1.98	- 1.83

\*P < .05 when t > 1.66 using one tail area of t distribution and > 200 degrees of freedom (P < .05 when t > 1.98 using two tail)

† Multiple regression analysis using lung function test values as the dependent variable and skin reactivity, age, height, and smoking as independent variables.

\*\* Common allergens.

†† Individual sum of wheal reactions to common allergens (CAA) or to grain antigens (grain).

TABLE 40b

REGRESSION COEFFICIENTS (b) AND T RATIOS (t) FOR THE SIGNIFICANT\*  
RELATIONS OF SKIN REACTIVITY TO COMMON OR SPECIFIC ANTIGENS AND PULMONARY  
FUNCTION ADJUSTED FOR AGE, HEIGHT, SMOKING HABIT USING MULTIPLE REGRESSION ANALYSIS†  
(CONTROLS)

		Total Wheat CAA††	Total Wheat Grain††	Durum Wheat	Barley	CAA**	Airborne Dust	Grain	Insects Mites	Fungi	Settled Dust
FEV <sub>1</sub> / FVC	b t										
FEV <sub>1</sub>	b t				244.0 1.88						
FVC	b t	3.52 2.12	5.73 2.49		3.60 2.51		110.9	.198 1.67		186.0	212.0 2.03
MMF	b						-19.6 - 1.78				-26.3 - 2.11
V <sub>MAX</sub> 50	b t										
V <sub>MAX</sub> 75	b t										
ΔN <sub>2</sub> /L	b t										
DL	b t							2.12 1.70			

\*P < .05 when t > 1.66 using one tail area of t distribution and 200 degrees of freedom (P < .05 when t > 1.98 using two tail)

† Multiple regression analysis using lung function test values as the dependent variable and skin reactivity, age, height, and smoking as independent variables.

\*\* Common allergens.

†† Individual sum of wheat reactions to common allergens (CAA) or to grain antigens (grain).

TABLE 41a

PREVALENCE OF ABNORMAL FUNCTION IN POSITIVE  
AND NEGATIVE SKIN REACTIONS

GRAIN WORKERS (305)

	Abnormal FEV <sub>1</sub> /FVC								Abnormal MMF < 1.65 SD								Abnormal V50 < 1.65 SD								Abnormal $\Delta$ N <sub>2</sub> /L > 1.65 SD							
	ALL		S		EX		NS		ALL		S		EX		NS		ALL		S		EX		NS		ALL		S		EX		NS	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Common Allergens	+ 46	8 17	3 7	5 11	0	-	9 20	3 7	6 13	0	-	20 43	6 13	7 15	7 15	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
Airborne Dust	+ 81	12 15	6 7	6 7	0	-	14 17	4 5	10 12	0	-	34 42	16 20	14 17	4 5	35 43	NS	<.001	<.001	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
Insects Mites	+ 69	14 20	8 12	6 9	0	-	14 20	7 10	7 10	0	-	30 43	16 23	10 14	4 6	23 33	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		
Fungi	+ 35	11 31	4 11	7 20	0	-	16 46	6 17	10 29	0	-	24 69	11 31	11 33	2 6	17 49	<.05	<.001	<.001	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05		

+Positive to one or more antigens of the group of antigens.

%Percentage of skin reactions or nonreactions with the abnormal function for each smoking category.

S = Smoker; EX = Ex-smoker; NS = Nonsmoker.

TABLE 41b

PREVALENCE OF ABNORMAL FUNCTION IN POSITIVE  
AND NEGATIVE SKIN REACTIONS

CONTROL (235)

	Abnormal FEV <sub>1</sub> /FVC								Abnormal MMF < 1.65 SD								Abnormal V50 < 1.65 SD								Abnormal ΔN <sub>2</sub> /L > 1.65 SD								
	ALL		S		EX		NS		ALL		S		EX		NS		ALL		S		EX		NS		ALL		S		EX		NS		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Common Allergens	+ 51	1	2	1	2	0	-	0	-	2	4	2	4	0	-	0	-	9	18	5	10	3	6	1	2	3	6	9	18	3	6	1	2
	NS								NS								NS								NS								
Airborne Dust	-184	15	8	8	4	6	3	1	1	10	5	7	4	3	2	0	-	37	20	16	9	16	9	5	3	38	21	26	14	9	5	3	2
	+ 48	3	06	0	-	2	4	1	2	1	2	0	-	6	13	2	4	2	4	2	4	14	29	6	13	5	10	3	6				
	NS								NS								NS								NS								
Insects Mites	-187	17	9	9	5	8	4	0	-	11	6	9	5	2	1	0	-	40	21	19	10	17	9	4	2	54	29	37	20	14	7	3	2
	+ 36	2	6	0	-	2	6	0	-	1	3	0	-	1	3	0	-	3	8	0	-	3	8	0	-	11	31	8	22	3	8	0	-
	NS								NS								<.1								NS								
Fungi	-199	36	15	19	8	11	5	6	3	44	19	24	10	16	7	4	2	98	42	50	21	33	14	15	6	74	31	47	20	19	8	8	3
	+ 29	2	7	1	3	1	21	0	-	2	7	2	7	0	-	0	-	8	28	4	14	2	7	2	7	7	24	5	17	1	3	1	3
	NS								NS								NS								NS								
	-206	14	7	8	4	5	2	1	0	10	5	7	3	3	1	0	-	38	18	17	8	17	8	4	2	44	21	30	15	11	5	3	1

+Positive to one or more antigens of the group of antigens.

%Percentage of skin reactions or nonreactions with the abnormal function for each smoking category.

S = Smoker; EX = Ex-smoker; NS = Nonsmoker.

TABLE 42

## PREVALENCE OF SYMPTOMS IN POSITIVE AND NEGATIVE SKIN REACTORS - (GRAIN WORKERS)

	Skin Reaction	CAA		ABD		I-M		Fungi		Grain		SD		D Wh		Barley		Oats		Rye	
		+	-	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total No.	+	46		+81		+69		+35		+38		+46		+65		+27		+12		+17	
	-	259		-224		-236		-270		-267		-259		-240		-278		-287		-288	
Chronic Bronchitis	+	21	46	39	48	32	46														
	-	127	49	109	49	116	49														
Cough on Exposure	+	32	70	55	68	45	65	27	77	27	71	30	65	43	66	20	74	11	61	14	82
	-	165	64	142	63	152	64	170	63	170	64	167	64	154	64	177	64	186	65	183	64
Occupational Asthma I	+	30	65	55	68	45	65	26	74	27	71	31	67	44	68	19	70	9	50	12	71
	-	150	58	125	56	135	57	154	57	153	57	149	58	136	57	161	58	171	60	168	58
Dyspnea on Exposure	+	27	59	44	54	34	49	24	69	25	66	28	61	37	57	16	59	10	56	10	59
	-	121	47	104	46	114	48	124	46*	123	46*	120	46	111	46	132	47	138	48	138	48
Nasal Sx on Exposure	+	38	83	66	81	56	81	30	86	37	97	40	87	57	88	27	100	18	100	17	100
	-	199	77	171	76	181	77	213	79	206	77*	203	78	186	78	216	78*	225	78*	226	78
Grain Fever	+	19	41	25	31	21	30														
	-	80	31	74	33	78	33														
Cough First Thing in A.M.	+	16	35	29	36	29	42														
	-	90	35	77	34	77	33														
Wheezing at Night	+	11	24	17	21	15	22														
	-	50	19	44	20	46	19														
Occupational Asthma IV	+	12	26	20	25	13	19														
	-	56	22	48	21	55	23														
Occupational Asthma II	+	25	54	44	54	37	54														
	-	118	46	99	44	106	45														

\*Significant ( $P < .05$ ) by  $\chi^2$ ; CAA = Common Allergens; ABD = Airborne Grain Dust;  
I-M = Insects and Mites; SD = Settled Dust; D WH = Durum Wheat

TABLE 43

## PREVALENCE OF POSITIVE DELAYED HYPERSENSITIVITY SKIN TESTS

Dose Injected	Grain Workers (N=232)		Controls (N=156)		$\chi^2$	Source	Lot No.	Stock Concentration	Working Solution* (ml)	Skin Test Antigen Concentration (0.1 ml)
	n	%	n	%						
PPD (Tinne Tests)	34	14	15	10	NS					
SK/SD (4 u/lu) (Varidase)	164	71	89	57	<.01	Lederle	500-283	20000 U SK	40 U SK	4 U
Mumps skin test antigen (0.1 ml)	104	45	95	61	<.005	Lilly	OH544A	1.0 ml	-	0.1 ml
Trichophyton 1:1000 w/v	90	39	28	18	<.001	Hollister- Steir	H9701702	1:10 w/v	1:10	1:1000
Candida (Monilia) Albions Antigen (10 PNU)	28	12	50	32	<.001	Hollister- Steir	6108934	10,000 PNU	100 PNU	10 PNU
To 2 or More	134	58	104	67	NS					

\*All dilutions prepared in sterile Coca's non-allergenic buffer.

Tests were considered positive when induration was: >5.0 mm for SK/SD, Trichophyton and Candida;  $\geq$ 10 mm for PPD or Erythema,  $\geq$ 15 mm for mumps and after 48 hours of .1 cc of solution injected intradermally.

TABLE 44  
PREVALENCE OF PRECIPITATING ANTIBODIES

	GRAIN WORKERS (310)		CONTROLS (236)	
	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>
1. <i>Aerobasidium</i>	2	.6	0	0
2. <i>Alternaria</i>	0	0	0	0
3. <i>Aspergillus clavatus</i>	1	.3	0	0
4. <i>Aspergillus falvus</i>	0	0	0	0
5. <i>Aspergillus fumigatus</i> (1)	5	1.6	0	0
6. <i>Aspergillus fumigatus</i> (5)	1	.3	8	3.4
7. <i>Aspergillus fumigatus</i> (6)	0	0	1	.4
8. <i>Aspergillus fumigatus</i> (8)	0	0	0	0
9. <i>Aspergillus fumigatus</i> (9)	0	0	0	0
10. <i>Aspergillus fumigatus</i> (1022)	1	.3	1	.4
All <i>Aspergillus fumigatus</i> 5-10	0	0	0	0
One or more <i>Aspergillus fumigatus</i> 5-10	7	2.2	10	4.0
11. <i>Aspergillus niger</i>	1	.3	1	.4
12. <i>Candida Albicans</i>	2	.6	2	.8
13. <i>Cephalosporium</i>	1	.3	3	1.3
14. <i>Fusarium</i>	3	.9	5	2.1
15. <i>Hormodendrum</i>	5	1.6	5	2.1
16. House dust	4	1.2	6	2.5
17. <i>Micropolyspora faeni</i> (Greer)	3	.9	4	1.7
18. <i>Micropolyspora faeni</i> (Marsh)	0	0	0	0
19. <i>Micropolyspora faeni</i> (UW)	4	1.2	2	.8



TABLE 44 (Cont'd.)

	GRAIN WORKERS (312)		CONTROLS (236)	
	N	%	N	%
20. Moldy hay	87	27.8	78	33.1
All micropolyspora faeni and hay 17-20	0	0	0	0
One or more micropolyspora faeni or hay 17-20	89	29.0	82	34.0
21. Mucor	0	0	2	.8
22. Penicillium casei	1	.3	1	.4
23. Penicillium rubrum	7	2.2	5	2.1
24. Phoma	3	.9	9	0
25. Pigeon sera	0	0	2	.8
26. Trichoderma	3	.9	14	5.9 <.001
27. Thermoactinomyces candidus (Kosky)	5	1.6	0	0
28. Thermoactinomyces candidus (UW)	4	1.2	0	0
29. Thermoactinomyces vulgaris (Greer)	1	.3	34	14.4 <.001
30. Thermoactinomyces vulgaris (H/S)	7	2.2	25	10.6 <.001
31. Thermoactinomyces vulgaris (Marsh)	6	1.9	4	1.7
All Thermoactinomyces vulgaris	0	0	1	0
One or more Thermoactinomyces vulgaris	11	3.5	38	16.0 <.001
32. Thermoactinomyces sacchari	2	.6	45	19.1 .001
33. Thermoactinomyces viridans	15	4.8	6	2.5
One or more of above 1-33	115	37.0	133	56.0 <.00
34. Wheat Durum	11	3.5	2	.8 <.05
35. Wheat Spring	14	4.4	0	0
36. Barley	10	3.2	3	1.3
37. Corn	14	4.4	15	6.4
38. Rye	11	3.5	2	.8 <.05
39. Oats	10	3.2	6	2.5

TABLE 44 (Cont'd.)

	GRAIN WORKERS (312)		CONTROLS (236)	
	<u>N</u>	<u>X</u>	<u>N</u>	<u>X</u>
40. Sunflower seeds	3	.9	7	3.0
41. Small seeds	21	6.7	11	4.7
One or more of above 34-41	38	12.0	28	12.0
42. Wheat durum dust	25	8.0	2	.8 <.001
43. Wheat spring dust	21	6.7	0	0
44. Barley dust	14	4.4	3	1.3 <.05
45. Corn dust	21	6.7	15	6.4
46. Rye dust	17	5.4	2	.8 <.005
47. Oats dust	25	8.0	6	2.5 <.01
48. Sunflower seed dust	7	2.2	0	0
49. Soybean dust	0	0	0	0
50. Settled dust I	94	30.1	59	25.0
51. Settled dust II	21	6.7	12	5.1
52. Settled dust III	30	9.6	11	4.7 <.05
One or more 42-52	115	37.0	70	29.0 <.1
53. Mites mixed	4	1.2	1	.4
54. Beetles mixed	3	.9	0	0
55. Weevils mixed	0	0	2	.5
One or more 53-55	7	2.2	3	1.0
One or more 34-55	123	40.0	80	33.0

TABLE 45  
BLOOD CHEMISTRIES

		G = Grain		C = Control Workers			Grain Workers		
		N	Mean	SD	Unpair t	N	Abnormal %	P	Values 2 SD of Controls
Cholinesterase (4-16 $\mu$ /l)	G	308	10.9	3.68	-2.21*	7	2	NS	5
	C	234	11.6	2.99		10	4		
GGT (Upper breath) (30 $\mu$ /l)	G	205	21.7	13.1	1.15	64	21	.05	6
	C	232	20.0	20.8		31	13		
Creatinine (0.4-19 ml/l)	G	305	1.20	.22	8.92*	3	1	NS	59
	C	232	1.05	.14		0	--		
SGPT (10-50 $\mu$ /l)	G	302	25.3	15.2	8.23*	8	3	NS	30
	C	234	15.6	10.9		5	2		
HGB GM%	G	306	16.1	1.14	.931				
	C	192	16.0	1.03					
HCT%	G	306	47.5	2.84	6.54*				
	C	192	45.8	2.53					

\*=P < .01

( ) in parentheses normal range for our laboratory.

TABLE 46  
URINALYSIS

	Grain Worker N=303		Control Worker N=231	
	N	%	N	%
Blood	6	2	5	2
Glucose TR	4	1	1	
>2+	0	0	5	2
Protein TR	29	10	8	3.5
>1+	10	3	6	3.

TABLE 47  
 RADIOLOGICAL FINDINGS IN GRAIN WORKERS  
 AND CONTROLS

	Grain Workers (293)		Controls (236)		P
	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	
<b>Thorax</b>					
Normal	264	90	218	93	
Rib fracture (old)	12	4	5	2	NS
Degenerative spine changes	16	5	5	2	<.1
Scoliosis (mild)	2	1	5	2	
Other			3*	1	
<b>Heart</b>					
Normal	292	100	236	100	
Questionably enlarged	1	0			
Enlarged					
<b>Lungs</b>					
Normal	279	95	225	95	
Nodule(s) calcified	2	1	6	3	
Nodule(s) non-calcified	4	1	2	1	
Mass (>2.5 cm)	0	0	2 <sup>+</sup>	1	
Reticulonodular pattern	0	0	0	0	
Band atelectasis or fibrosis	5	2	1	0	
Blebs	3	1	1	0	
Hyperinflation	1	0	0	0	
<b>Pleura</b>					
Normal	280	95	228	96	
Apical thickening	2	1	3	1	
Costophrenic angles-unilateral	9	3	4	2	NS
-bilateral	4**	1	1**	0	
Post thoracotomy changes	1 <sup>+</sup>	0	2 <sup>++</sup>	1	

\*One rib fibrodysplasia, one pectus excavatus, one mild old fracture of clavicle.

<sup>+</sup>One bilateral hilar mass, probably lymphoma, one paratracheal node.

\*\*One grain worker and one control with calcification of pleura.

<sup>++</sup>One grain worker and one control rib resection from thoracotomy, one control mid-sternal sutures from mid-sternotomy for coronary bypass.

TABLE 48

## LEVEL OF IMMUNOGLOBULINS (G,A,M)\* IN GRAIN WORKERS AND CONTROLS

	Number Tested	IgG mg/dl	IgA mg/dl	IgM mg/dl
Grain Workers	307	1587 $\pm$ 27	266 $\pm$ 6	156 $\pm$ 4
Controls	235	1436 $\pm$ 23**	238 $\pm$ 6**	151 $\pm$ 5

\*Results expressed as Mean  $\pm$  Standard Error of the Mean

\*\*Statistically significant ( $p < 0.05$ ) between grain workers and controls with Students t test.

TABLE 49

LEVELS OF IMMUNOGLOBULINS (G,A,M)\* IN SMOKING, EX-SMOKING AND  
NONSMOKING GRAIN WORKERS AND CONTROLS

	<u>Smokers</u>		<u>Ex-smokers</u>		<u>Nonsmokers</u>	
	Grain Workers (N=180)	Controls (N=105)	Grain Workers (N=92)	Controls (N=67)	Grain Workers (N=65)	Controls (N=63)
IgG mg/dl	1514±36	1384±36**	1687±35**	1427±35**	1631±62	1532±45**
IgA mg/dl	246±8	236±10	288±12	238±11**	280±15	241±12**
IgM	148±7	151±7	163±8	143±8	167±9	160±9

\*Results expressed as the Mean ± Standard error of the Mean

\*\*Statistically significant (p < 0.05) with Students T test using comparisons of means between grain workers and controls in each smoking category.

TABLE 50

THE LEVELS OF IMMUNOGLOBULINS (G,A,M)\* IN AGE GROUPED GRAIN WORKERS AND CONTROLS

	<u>&lt;20 Years</u>		<u>21-30 Years</u>		<u>31-40 Years</u>		<u>41-50 Years</u>		<u>51-60 Years</u>		<u>61-70 Years</u>	
	Grain Workers (N=2)	Controls (N=2)	Grain Workers (N=97)	Controls (N=58)	Grain Workers (N=44)	Controls (N=72)	Grain Workers (N=50)	Controls (N=48)	Grain Workers (N=71)	Controls (N=44)	Grain Workers (N=12)	Controls (N=11)
IgG mg/dl	1531±722	1591±298	1475±42	1445±44	1533±77	1377±35**	1695±54	1401±59**	1658±55	1538±55	1579±03	1496±96
IgA mg/dl	182±118	164±14	235±12	213±11	251±15	234±11	305±13	241±15**	271±10	264±14	283±26	290±14
IgM mg/dl	170±86	133±28	170±08	164±10	143±10	138±07	147±08	163±14	158±10	149±09	149±20	135±16

\*Results expressed as the Mean ± Standard Error of the Mean.

\*\*Statistically significant (P &lt; 0.05) using Students t-test comparing the mean values of grain workers and controls in each age group.



TABLE 51

THE LEVELS OF IMMUNOGLOBULINS (G,A,M)\* BY LENGTH OF EMPLOYMENT  
IN AGE GROUPED GRAIN WORKERS AND CONTROLS

	<u>5.5 Years</u>		<u>5.6-10.5 Years</u>		<u>10.6-15.5 Years</u>		<u>15.6-20.5 Years</u>	
	Grain Workers (N=92)	Controls (N=76)	Grain Workers (N=77)	Controls (N=49)	Grain Workers (N=32)	Controls (N=37)	Grain Workers (N=45)	Controls (N=36)
IgG mg/dl	1535±49	1428±40	1537±51	1419±49	1780±103	1289±52**	1559±61	1512±59
IgA mg/dl	248±12	214±10**	257±14	248±14	298± 17	244±14**	274±15	237±17
IgM mg/dl	171± 9	157±10	157±10	154± 9	154± 11	155±12	156±10	156±11

	<u>20.6-25.5 Years</u>		<u>25.6-30.5 Years</u>		<u>30.6-35.5 Years</u>		<u>&gt; 35.6 Years</u>	
	Grain Workers (N=22)	Controls (N=17)	Grain Workers (N=30)	Controls (N=9)	Grain Workers (N=9)	Controls (N=7)	Grain Workers (N=2)	Controls (N=3)
IgG mg/dl	1578±81	1459±70	1748±91	1654±190	1546±158	1690±92	1673±242	1421±134
IgA mg/dl	279±23	298±22	295±20	228± 41	250± 27	264±27	284± 17	268± 90
IgM mg/dl	135±14	121± 1	136±11	132± 22	123± 23	135±14	198± 34	108± 34

\*Results expressed as Mean ± Standard Error of the Mean.

\*\*Statistically different (P < 0.05) using Students t-test of comparisons between mean levels of grain workers and controls in each age group or length of employment group.

TABLE 52

## IMMUNOGLOBULIN (G,A,M)\* LEVELS GROUPED BY PLACE OF EMPLOYMENT

	Grain Workers (N=307)	Elevator 1 (N=35)	Elevator 2 (N=21)	Elevator 3 (N=12)	Elevator 4 (N=49)	Elevator 5 (N=17)	Elevator 6 (N=16)	Elevator 7 (N=39)	Elevator 8 (N=24)
IgG mg/dl	1587±27	1737±95**	1612±101	1288±05	1560±56	1566±157	1556±30	1632±94	1714±122**
IgA mg/dl	266±06	266±16	273±17	301±04	264±16	278±39	286±30	264±21	281±25
IgM mg/dl	156±04	147±13	186±20	162±24	158±09	143±15	133±15	160±80	153±22

\*Results expressed as mean ± standard error of the mean.

\*\*Statistically significant (P < 0.05) of the difference between mean level of the grain workers and the mean level for each elevator company.

TABLE 53

ALPHA<sub>1</sub>-ANTITRYPSIN (AAT) LEVELS\* IN  
SMOKERS, EX-SMOKERS AND NONSMOKERS

	Smokers		Ex-smokers		Nonsmokers		All	
	Grain Workers (N=150)	Controls (N=105)	Grain Workers (N=92)	Controls (N=67)	Grain Workers (N=65)	Controls (N=67)	Grain Workers (307)	Controls (234)
AAT mg/dl	306 ± 7**	329 ± 7	284 ± 8	302 ± 10	292 ± 10	281 ± 12	296 ± 5	308 ± 6

\*Results expressed as Mean ± Standard Error of the Mean.

\*\*Statistically significant (P < 0.05) using Students t-test.

TABLE 54a

LEVELS OF ALPHA<sub>1</sub>-ANTITRYPSIN\* IN AGE GROUPED GRAIN WORKERS AND CONTROLS

<u>20</u> <u>Years</u>		<u>21-30</u> <u>Years</u>		<u>31-40</u> <u>Years</u>		<u>41-50</u> <u>Years</u>		<u>51-60</u> <u>Years</u>		<u>61-65</u> <u>Years</u>	
Grain Workers (N=2)	Controls (N=2)	Grain Workers (N=97)	Controls (N=58)	Grain Workers (N=44)	Controls (N=72)	Grain Workers (N=80)	Controls (N=48)	Grain Workers (N=71)	Controls (N=44)	Grain Workers (N=12)	Controls (N=11)
253±49	345±23	270±08	302+9**	297±13	288±10	306±8**	342±17	315±10	312±12	331±32	317±16

\*Results expressed as the Mean ± Standard Error of the Mean.

\*\*Statistically significant (P < 0.05) using Students t-test.

TABLE 54b

LEVELS OF ALPHA<sub>1</sub>-ANTITRYPSIN\* IN GRAIN WORKERS AND CONTROLS GROUPED  
ACCORDING TO LENGTH OF EMPLOYMENT

<u>5.5</u> <u>Years</u>		<u>5.6-10.5</u> <u>Years</u>		<u>10.6-15.5</u> <u>Years</u>		<u>15.6-20.5</u> <u>Years</u>	
<u>Grain</u> <u>Workers</u> (N=92)	<u>Controls</u> (N=76)	<u>Grain</u> <u>Workers</u> (N=17)	<u>Controls</u> (N=49)	<u>Grain</u> <u>Workers</u> (N=32)	<u>Controls</u> (N=37)	<u>Grain</u> <u>Workers</u> (N=45)	<u>Controls</u> (N=36)
284±8**	306±8	288±10	288±12	298±15	304±14	305±12	314±12

<u>20.6-25.5</u> <u>Years</u>		<u>25.6-30.5</u> <u>Years</u>		<u>30.6-35.5</u> <u>Years</u>		<u>35.6</u> <u>Years</u>	
<u>Grain</u> <u>Workers</u> (N=22)	<u>Controls</u> (N=17)	<u>Grain</u> <u>Workers</u> (N=30)	<u>Controls</u> (N=9)	<u>Grain</u> <u>Workers</u> (N=9)	<u>Controls</u> (N=7)	<u>Grain</u> <u>Workers</u> (N=2)	<u>Controls</u> (N=3)
314±14	343±35	305±14	353±20	353±40	326±54	417±33	322±54

Results expressed as Mean ± Standard Error of the Mean.  
Statistically significant (P < 0.05) using Students t-test.

TABLE 55

THE TRYPSIN INHIBITORY CAPACITY AND ALPHA<sub>1</sub>-ANTITRYPSIN (AAT)  
PHENOTYPE OF SUBJECTS WITH INTERMEDIATE LEVELS OF AAT

Subject No.	T.I.C.*	%**	Pi Type	Age (Yrs)	Smoking
18	1.40	118.6	M		
52	.92	77.9	MS	27	Ex
98	1.30	110.0	M		
133	1.36	115.2	M		
143	1.27	107.9	MS	30	S
210	.94	79.6	MS	21	MS
232	.63	55.5	MZ	36	MS
239	.72	61.5	MZ	31	S
240	.81	68.6	MZ	28	Ex

\*Trypsin inhibitory capacity expressed as mg of trypsin inhibited per ml of serum.

\*\*Percentage of normal standard pool.

TABLE 56

IMMUNOGLOBULIN (G,A,M) AND ALPHA<sub>1</sub>-ANTITRYPSIN (AAT) LEVELS IN GRAIN WORKERS WITH (+) OR WITHOUT (-) ABNORMAL PULMONARY FUNCTION

Abnormal Condition		N	X	<u>IGA</u>			<u>IGG</u>			<u>IGM</u>			<u>AAT</u>		
				±SD	P	X	±SD	P	X	±SD	P	X	±SD	P	
FEV <sub>1</sub> /FVC <70%	+	51.0	286.2	96.7		1540.4	458.4		144.2	76.1		306.4	77.8		
	-	25.9	262.1	113.7	NS	1596.8	469.7	NS	158.6	78.9	NS	294.4	83.7	NS	
FVC <80%	+	17.0	331.4	138.1		1815.1	540.3		151.3	76.5		331.5	83.1		
	-	293.0	262.2	108.6	<.025	1574.3	460.5	<.05	156.6	78.7	NS	294.3	82.4	NS	
V <sub>max</sub> 50 <1.65	+	130.0	285.0	108.8		1608.8	515.7		150.4	74.9		306.0	74.9		
	-	180.0	252.3	111.4	<.025	1572.3	430.2	NS	160.6	80.9	NS	289.3	80.3	NS	
MMF <1.65	+	60.0	290.2	104.1		1641.6	510.2		147.3	76.0		315.0	81.6		
	-	250.0	260.3	112.4	NS	1574.8	457.0	NS	158.4	79.1	NS	292.0	82.6	NS	
V <sub>max</sub> 75 <1.65	+	153.0	277.8	114.1		1621.3	520.1		156.8	84.9		303.8	84.8		
	-	157.0	254.5	107.6	NS	1554.6	408.6	NS	155.8	71.9	NS	289.1	80.3	NS	
CV <1.65	+	43.0	283.3	132.7		1534.2	434.8		158.3	70.0		289.7	83.0		
	-	267.0	263.2	107.4	NS	1596.3	472.9	NS	156.0	79.9	NS	297.4	82.8	NS	
ΔN2/L <1.65	+	100.0	260.7	105.0		1616.0	142.2		142.2	86.5		321.1	92.4		
	-	210.0	268.5	114.4	NS	1574.2	468.5	<.05	163.0	73.7	<.05	284.6	75.2	<.005	
DL <80%	+	22.0	333.8	120.8		1655.1	547.8		137.9	74.0		343.0	72.9		
	-	288.0	260.8	109.1	<.01	1582.4	461.5	NS	157.7	78.8	NS	292.8	82.5	<.01	

TABLE 57

REGRESSION COEFFICIENTS (b) T RATIOS (t) AND SIGNIFICANCE (p) IN MULTIPLE REGRESSION OF IMMUNOGLOBULIN (A,G,M) AND ALPHA<sub>1</sub>-ANTITRYPSIN (AAT) LEVELS ON GRAIN DUST EXPOSURE, SMOKING HABIT, AGE AND/OR LENGTH OF EMPLOYMENT (LOE)

		Age	Smoking	Ex- Smoking	Grain	LOE	Smoking	Ex- Smoking	Grain
IgA	(b)	1.237	- 20.8	2.2	28.63	1.735	-19.8	-5.4	28.34
	(t)	2.5	- 1.86	.18	3.20	4.63	- 1.8	- .44	3.22
	(p)	.01	.05	NS	.005	.0001	.05	NS	.005
IgG	(b)	4.55	-132.8	-46.0	157.6	3.99	-134.5	-27.5	NS
	(t)	2.99	- 2.97	- .93	4.4	2.01	- 2.99	- .56	157.6
	(p)	.005	.005	.005	.0001	.025	.005	NS	.0001
IgM	(b)	- .394	- 15.07	- 7.48	6.30	-1.150	- 15.67	- 7.79	7.07
	(t)	-1.41	- 1.84	- .82	.96	-3.19	- 1.93	- .87	1.09
	(p)	.0001	.05	NS	NS	.0001	.005	.05	NS
AAT	(b)	1.586	32.37	- 2.96	-15.83	1.578	31.94	3.21	-15.99
	(t)	5.26	3.65	- .30	- 2.23	3.97	3.56	.33	-2.23
	(p)	<.0001	<.0001	<.0005	<.025	<.0001	<.0005	<.0005	<.025