PECAN NUT YIELD WITH SOURCES AND MAGNITUDE OF PECAN NUT DAMAGE IN A COMMERCIALLY MANAGED PECAN ORCHARD

By

STEVEN ROBERT JIRACEK

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Oklahoma State University

Stillwater, Oklahoma

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Thesis Approved:

L. D. Ekenberry

Thesis Adviser

Robert D Morrison

George L. Barnes

Don C Peters

Norman N Durham

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

The pecan tree, Carya illinoensis (Wang.) K. Koch is a deciduous, nut bearing tree, belonging to the family Juglandaceae. The tree possesses a strong wood, rich in color, and the tree is said to be the largest of the native hickories. Although the wood is used for many products, the nut is more valuable. The pecan is considered the most important native horticultural crop in the United States (Brison 1974).

The range of the native pecan tree includes Arkansas, Louisiana, Mississippi, Oklahoma, and Texas. Native trees in smaller areas are found in Kansas, Missouri, Tennessee, Kentucky, Illinois and Iowa (Brison 1974). Improved cultivars have been planted in these areas along with other states beyond its native range. These states include New Mexico, Arizona, California, Alabama, Georgia, Florida and South Carolina (Brison 1974).

Total pecan production in the United States has increased progressively for the past 50 years (Brison 1974). The average annual value of pecans from 1976-79 in the United States was $123 million. In Oklahoma, from 1976-79 the crop had an average annual value of $7.5 million (Anon. 1977, 1978, 1979a, 1980).

Through the growing season numerous insects, diseases, environmental stresses and physiological impairments plague both the nut

and the tree. These stresses can cause a large loss of good pecan nuts in a growing season.

The pecan weevil, Curculio carya (Horn), is generally considered as one of the most important pest in nut production in most pecan growing areas (Boethel and Eikenbary 1979). Neel and Shepard (1976) indicated that this is the most important arthropod pest on pecans. Estimated damage from the pecan weevil has ranged from 35 to 50 million pounds annually (Anon. 1970). Raney et al. (1970) and Eikenbary et al. (1977) reported that more than 4000 weevils can emerge from the soil under one pecan tree.

Damages caused by the weevil includes adult feeding, oviposition and larval feeding. Adult feeding damage results in: 1) Black spots on the kernel, 2) shrivelled kernels and 3) premature nut drop. Ovipositional damage results in total destruction (Moznette et al. 1931, 1940, Hinrichs and Thompson 1955, Boethel and Eikenbary 1979).

Controlling the pecan weevil with chemical insecticides is the most common control method used. Treatments are directed at the adult stage, since this is the stage that is most susceptible to the toxicant.

The hickory shuckworm, Laspeyresia caryana (Fitch), is considered a destructive pest throughout the pecan belt (Osburn et al. 1963). Four types of injury occur to the nut by mining or tunneling by the larvae: 1) Premature nut drop caused by the larvae attacking young nuts, 2) improper development of the kernel to fill out properly after the nut shell has hardened, 3) natural separation of the shuck from the shell does not occur and, 4) delayed maturity (Moznette et al. 1931, 1940, Walker 1933). When the shuck remains partially or com-

pletely attached around the shell at processing time, the nut will be rejected for commercial use even if the kernel might meet market standards. Timing of chemical insecticide spray is the primary method of controlling this pest.

The Southern green stinkbug, Nezara viridual (L.), and leaf-footed bug, Leptoglossus phyllopus (L.) cause black spot and kernel spot of pecan nuts. This type of damage can cause premature nut drop which is similar to that caused by the pecan weevil and shuckworm (Osburn et al. 1963). After the shell becomes hardened, the nut will not separate from the shuck and the blackened spots are detected on the kernel and this renders pecans valueless (Annon. 1979c). Removal of alternate preferred host plants from the vicinity of the pecan orchard would reduce the incidence of these pests (Bissell 1929).

The pecan tree is affected by fungal, bacterial and virual diseases and by environmental disorders of various kinds (Osburn et al. 1963). The pecan diseases can cause numerous pecan nut losses throughout the growing season.

Pecan scab, incited by the fungus Fusicladium effusum (Wint.), is a major limiting factor in the commercial production of nuts from susceptible cultivars, seedling and native trees of the pecan (Barnes 1977). If scab is not controlled, the entire crop may be lost or greatly reduced in quality (Barnes 1977).

During midsummer, shuck dieback and stem-end blight can cause blackening and splitting of immature shucks (Payne et al. 1979). Pink mold and powdery mildew can also cause damage to nuts during nut development.

Fungal diseases such as downy spot, vein spot, and brown leaf

spot, reduce leaf area which can reduce nut productivity indirectly. Many other diseases may plague the tree and reduce pecan nut production.

Environmental and physiological stresses can reduce a tremendous amount of nut productivity. Climate, soil nutrition, genetic variation, water deficiency and mechanical injuries, coupled with many other types of tree stresses, plague the tree and cause nut abortion throughout its lifetime (Crane 1931; Finch and VanHorn 1936; Hamilton 1942; Dodge 1946; Boyce 1961; Wright 1976; O'Barr 1976; Daniel et al. 1979; Wolstenholme 1979).

In a commercially managed pecan orchard some stress conditions can be reduced. The use of irrigation in pecan orchards increases pecan nut production in comparison to non-irrigated orchards (Daniel 1978). O'Barr (1976) points out the need of nutrients for tree development and nut productivity. However, more needed research in these areas should be conducted to limit the large amount of nut loss due to environmental and physiological stress.

Animal damage to pecans has long been a problem (Hoffman 1924, McDowell and Pillsbury 1959). Crows, blue jays and other animals have been reported as "stealing" the crop. Mean annual losses of pecans to wildlife in Oklahoma average from 8-10 percent of the total (Anon. 1979b).

The effect of machine damage to pecan nut cultivars has not been evaluated before the start of this research project. Information regarding different amounts of pecan shuck cover and pecan nut sizes was needed before damage assessment could be implemented.

The primary objective of this study was to determine total amount of nuts produced and the various damage types using a mechanized harvest operation in a commercially managed orchard.

CHAPTER II

METHODS AND MATERIALS

The study site consisted of trees chosen from a 202.3 hectare orchard located on the Noble Foundation Red River Demonstration and Research Farm, Burneyville, Love County, Oklahoma. The study trees were selected because of a history of high weevil damage. Thus, statistical inference can only be made on those trees selected and not the orchard. The cultivars selected included "Stuart", "Texas 60", and "Squirrel".

Chemical applications were applied for phyloxera, Phylloxera devastatrix Pergande (Lindane®) aphid, Monellia costalis (Fitch) (Zolone®), pecan nut casebearer, Aerobasis nuxvorelle Neunzig (Zolone®), and pecan scab, Fusicladium effusum (Wint.) (Benlate®) as recommended by the 1976, 1977, 1978, and 1979 Oklahoma Pecan Insect and Disease Control Fact Sheet No. CR-6209. The control of the pecan weevil was accomplished by the methods and insecticides reported by Eikenbary et al. (1978).

When the study was initiated in 1976, nuts were harvested and processed. This consisted of shaking each tree with a tractor mounted shaker, picking up nuts with a self-propelled harvester and processing the nuts through a cleaning machine. The time of initiating harvest operations varied from year to year, ranging from October to November.

The post harvest samples were taken of blowover, conveyor belt

rejects, and a conveyor belt grab sample. Blowovers consisted of the lighter nuts and debris which were subject to removal by forced air flow. Conveyor belt rejects consisted of those nuts not removed by the blowover process, but unacceptable for commercial use and removed by hand labor. Conveyor belt grab samples were made by sampling ca. 100 nuts at random from the good nuts moving down the conveyor belt which were sacked, weighed and considered marketable.

In 1978, in addition to the post harvest samples, a pre-harvest sample was taken from the "Stuart" cultivar, consisting of a tree grab sample and a ground grab sample. Ground and tree samples were taken by randomly selecting 100 nuts per tree found on the ground and from the trees before harvest. The nut samples were taken to the laboratory for dissection to determine amount and type of nut damage. Total yield data were collected for each tree.

Evaluation of nuts was made by establishment of categories according to shuck cover and size. Three categories were developed to evaluate the condition of the shuck. "No Shuck" were those pecans that had little or no shuck present (<20%). "Partial Shuck" were those that had at least a portion (20-80%) of the shuck intact. "Complete Shuck" were those that had the entire shuck intact (>80%). Three categories were established to describe nut size. The categories separated nuts as: large in size, intermediate in size, or small in size for that cultivar (Tables 1, 2 and 3).

The nine possible categories are listed (Figure 1).

NL = No shuck - large

NM = No shuck - medium

NS = No shuck - small

Figure 1. Arrangement of Size and Shuck cover Categories for the Pecan Nut Cultivars.

ARRANGEMENT OF SIZE AND NUT SHUCK COVER CATEGORIES

SIZE OF NUTS

AMOUNT OF NUT SHUCK COVER	LARGE	MEDIUM	SMALL
NO	NL	NM	NS
PARTIAL	PL	PM	PS
COMPLETE	CL	CM	CS

CL = Completely covered - large

CM = Completely covered - medium

CS = Completely covered - small

PL = Partially covered - large

PM = Partially covered - medium

PS = Partially covered - small

Measurement ranges for each cultivar were developed as guide lines for determining the size category. "Stuart" ranged from 3.8 - 3.0 cm for large, 2.9 - 2.6 cm for medium and 2.5 - 1.5 cm for small. "Texas 60" ranged from 3.3 - 2.9 cm for large, 2.8 - 2.5 cm for medium and 2.4 - 1.5 cm for small. "Squirrel" ranged from 3.9 - 3.1 cm for large, 3.0 - 2.6 cm for medium and 2.5 - 1.5 cm for small.

Because a great amount of labor is involved in evaluating large numbers of pecans, random samples of 100 nuts for each of the nine categories were taken. In the event that a category did not have at least 100, all pecans available in that category were evaluated. The remaining nuts in the category in excess of 100 were counted to determine the statistical projected value for the category type.

Projected values were calculated by multiplying the total number of nuts in a category by the ratio of the number of nuts of each condition (i.e. good pecan, damaged by weevil, etc.) to the number evaluated in that category.

The following calculation was used:

$P = T \times C/E$

P = Projected value

T = Total number of nuts in a category

C = Number of nuts with a damaged condition

E = Number of nuts evaluated in a category

The commercial good nuts that remained after the cleaning procedure was determined by obtaining the weight of these nuts and the number of nuts per pound for that cultivar and year. Calculation of nut count was then obtained.

Nuts in each of the nine different categories were examined and damage types were then determined. Guide lines for determining damage type were as follows:

Weevil Puncture: Pecan weevil feeding is characteristic of a puncture on the kernel resulting in a darkened area lacking in uniformity.

Weevil Holes: The larva makes an ca. 0.3 cm circular hole for exiting. Occasionally multiple weevil holes were encountered.

Larvae Present: Larvae in the nut.

Stinkbug: Stinkbug feeding causes a characteristic circular darkened area of uniform shape on the kernel.

Hickory Shuckworm: Shuckworm larvae cause characteristic mining on mature nuts and were found when a portion of the shuck is intact and it was observed at times on the shell. If the nut was attacked before the shell hardens, the nut aborted and there was destruction of the nut. The larva must be present to recognize this type of damage.

Disease: Disease characteristics were determined for those nuts in which the shell was not opened prior to evaluation. If diseased, the fruit has an unusual and abnormal or unnatural appearance. If cracked prior to evaluation and mycelial growth is noted then this is concered a saprophytic disease that occurred after nut filling.

Nuts with this condition resulted in the "Black" category.

Black Kernel: Diagnosis of this characteristic was made when the kernel was dehydrated and black in color.

Shrivelled Kernel: Diagnosis of this characteristic was made if the kernel was dehydrated and brown in color.

Animal: Animal damage is generally diagnosed by characteristic jagged sawtooth-like breaks in the shell, or punctures, coupled with partial or total removal of the kernel.

Mechanical damage: Physical damage that occurs by machinery or other physical processes during or after harvesting operations. Breakage of the shell or shuck, with no set pattern is characteristic.

It was possible to have more damaged nuts than there was nuts evaluated as a result of multiple damage types to a nut. Therefore, calculation of total nuts subtracted from the number of good nuts would equal the number of damaged nuts.

CHAPTER III

RESULTS

The evaluation procedure for the nuts consisted of: (1) Evaluation of tree production and damage, (2) evaluation of nuts of three sizes (large, medium and small) cross classified with three nut shuck cover categories (complete, partial and no shuck), and (3) evaluation of nuts processed through a cleaning machine by cultivar and year. The percentages have been rounded to the nearest one percent.

"Squirrel" Cultivar - 1976

Evaluation of Tree Production and Nut Damage

Tables 1, 2 and 3 present a detailed analysis of the pecan nuts with the various types of damage. The average number of nuts produced by this cultivar was 5978 $\pm$ 1269 with 32% (1916/5978) damaged per tree. The major types of damage were (1) black kernels - 15% (878/5978); (2) shrivelled kernels - 7% (409/5978); (3) pecan weevil - 7% (407/5978); and (4) mechanical damage - 6% (338/5978) (Tables 2 and 3).

Nuts by Size and Shuck Cover

Pecan nuts in the "large size with no shuck" category comprised 83% (4989/5978) of the total number of nuts per tree and represented most of the marketable nuts (Tables 1 and 3). The majority of the damage to this category was due to (1) weevil damage - 71% (463/4989);

TABLE 1

MAJOR TYPES OF DAMAGE[a/][b/][c/] TO THE AVERAGE YIELD FROM "SQUIRREL" CULTIVAR TREES BY SIZE OF NUT AND AMOUNT OF SHUCKCOVER ON THE PECAN. NOBLE FOUNDATION RED RIVER FARM, BURNEYVILLE, LOVE COUNTY, OKLAHOMA 1976[d/].

Amount of shuck on the nut	Size of nut (cm)		
	Large (3.9-3.1)	Medium (3.0-2.6)	Small (2.5-1.5)
No shuck			
Collected	4989	316	21
Damaged	21%	80%	81%
Types of damage			
	7% Weevil	39% Black	43% Shrivelled
	6% Black	29% Shrivelled	36% Black
	5% Mechanical	11% Mechanical	20% Mechanical
Partial shuck			
Collected	156	121	9
Damaged	87%	96%	89%
Types of damage			
	56% Black	59% Black	56% Black
	24% Shrivelled	35% Shrivelled	33% Mechanical
	15% Mechanical	16% Mechanical	32% Shrivelled
Complete shuck			
Collected	143	187	36
Damaged	99%	99%	100%
Types of damage			
	73% Black	82% Black	90% Black
	20% Shrivelled	18% Shrivelled	9% Shrivelled
	6% Weevil	4% Mechanical	9% Mechanical

a/ Percentages rounded to the nearest 1%.
b/ Damage Types: Shrivelled = Shrivelled Kernels, Mechanical = Mechanical damage, Black = Black Kernels, Weevil = Pecan Weevil.
c/ Multiple damage to some pecans caused certain categories to be greater than 100%.
d/ 5978 ± 1269 nuts were harvested from the average tree.

TABLE 2

DISTRIBUTION OF PECAN NUTS PROCESSED BY A CLEANING MACHINE[a/]
WITH VARIOUS TYPES OF DAMAGE

SOURCE [b/]	N [c/]	COLLECTED $\bar{X}$ [d/]	COLLECTED S [e/]	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK-BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "SQUIRREL" 1976																	
BLOWOVER	13	409.0	323.8	48.6	50.9	360.5	285.3	7.7	14.9	0.9	1.2	0.6	0.0	77.9	233.0	10.9	77.6
C-REJECT	13	1094.9	516.4	106.7	71.8	988.1	482.1	29.5	67.3	5.3	4.1	0.9	1.7	219.8	519.9	40.3	225.4
BELT*	13	361.7	103.8	320.9	102.8	40.8	41.7	15.1	1.1	3.3	4.0	0.0	0.0	8.1	9.1	0.4	2.7
SACK	13	4112.9	1192.4	3486.0	942.5	526.8	685.7	206.7	13.4	41.4	42.9	0.0	0.0	103.6	115.5	3.0	32.3
TOTAL	13	5978.5	1269.3	4062.2	109.8	1916.2	1260.5	259.0	96.7	51.0	52.2	1.5	1.7	409.4	877.5	54.6	338.0
CULTIVAR "TEXAS 60" 1976																	
BLOWOVER	8	2019.9	2111.0	1320.3	1646.4	699.6	493.8	35.4	62.5	23.4	51.3	11.5	12.3	168.8	219.5	22.3	213.7
C-REJECT	9	1160.7	772.8	102.1	137.4	1058.5	682.1	39.2	77.7	50.6	20.6	0.1	3.3	65.2	209.1	100.8	613.7
BELT*	9	291.9	135.1	266.3	137.8	25.5	34.2	1.5	0.0	0.9	3.6	0.0	0.0	0.1	0.5	0.0	19.4
SACK	9	13253.0	4536.4	11769.0	3808.0	1484.0	2211.8	64.8	0.0	37.8	135.3	0.0	0.0	8.6	19.8	0.0	1163.3
TOTAL	9	16725.5	6152.6	13457.7	4427.3	3267.6	2873.2	140.9	140.2	112.7	210.8	11.6	15.6	242.7	448.9	123.1	2009.8

TABLE 2 (CONTINUED)

SOURCE	N	COLLECTED $\bar{X}$	COLLECTED S	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK-BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "TEXAS 60" 1978																	
BLOWOVER	10	548.2	330.0	223.2	148.3	325.0	196.5	5.3	2.9	2.4	3.1	4.1	12.6	85.7	156.4	11.6	69.8
C-REJECT	9	1712.0	1331.9	559.0	675.8	1153.0	683.4	32.8	22.2	0.6	9.1	22.8	31.8	225.7	280.5	25.1	569.5
BELT*	10	192.8	82.7	183.1	78.7	9.7	7.5	2.6	0.0	0.0	0.6	0.0	0.0	2.8	0.0	0.0	3.8
SACK	10	12834.4	6614.9	12193.6	6376.8	640.8	636.7	178.5	0.0	0.0	26.3	0.0	0.0	107.6	0.0	0.0	332.8
TOTAL	10	15287.4	7208.0	13158.9	6661.2	2128.5	1196.1	219.2	25.1	3.0	39.1	26.9	44.4	421.8	436.9	36.7	975.9
CULTIVAR "STUART" 1978																	
BLOWOVER	10	218.3	106.4	90.2	63.9	128.1	59.3	2.0	3.7	0.1	0.7	4.1	2.0	38.4	72.9	1.8	21.7
C-REJECT	10	1876.7	1263.4	768.9	929.5	1107.8	533.3	38.9	119.9	5.1	5.5	38.8	15.5	412.8	242.3	12.0	305.9
BELT*	10	194.0	42.1	185.9	47.2	8.1	10.0	0.9	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.4
SACK	10	7595.0	8754.5	7288.3	3803.2	306.7	437.3	29.9	0.0	0.0	0.0	0.0	0.0	256.9	0.0	0.0	19.7
T-GRAB	10	94.7	19.2	89.6	19.7	5.1	2.5	0.7	0.1	0.1	0.5	0.2	0.1	2.8	0.3	0.0	0.0
G-GRAB	9	100.2	1.1	65.4	23.5	34.7	23.0	0.9	0.1	0.0	0.0	5.1	1.1	22.5	6.8	0.1	0.4
TOTAL	10	10078.9	4310.2	8488.3	3834.1	1590.5	857.4	73.3	123.8	5.3	6.7	48.2	18.7	740.4	322.3	13.9	348.1

TABLE 2 (CONTINUED)

SOURCE	N	COLLECTED $\bar{X}$	COLLECTED S	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK-BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
							CULTIVAR "STUART" 1979										
BLOWOVER	5	413.2	233.2	48.4	47.4	364.8	211.2	1.0	4.6	0.0	0.0	3.4	22.8	79.4	151.8	10.6	143.4
C-REJECT	5	1206.0	735.6	542.6	415.5	663.4	396.1	96.0	107.2	0.2	0.2	25.2	19.0	258.8	79.2	3.8	194.0
BELT*	5	251.0	47.7	231.2	54.6	19.8	16.7	1.4	0.0	0.0	0.0	0.4	0.0	2.4	1.6	0.0	14.0
SACK	5	7908.8	2754.1	7310.8	2667.1	598.0	450.4	57.4	0.0	0.0	0.0	8.8	0.0	121.2	91.2	0.0	319.2
T-GRAB	5	102.4	3.0	97.0	5.6	5.4	4.0	0.2	0.0	0.0	0.0	0.0	0.0	4.2	0.8	0.0	0.0
TOTAL	5	9881.4	3633.7	8230.0	3032.0	1651.4	921.7	156.0	111.8	11.2	0.2	37.8	41.8	466.0	324.6	14.4	670.6

a/ Portable Bowie Cleaner. Noble Foundation, Burneyville, OK

b/ Collected pecan from the cleaning process; T-GRAB = tree grab, G-GRAB = sample from ground, C-REJECT = conveyor belt rejects

c/ N = No. of trees in sample

d/ $\bar{X} = \Sigma X/N$

e/ $S = \sqrt{\frac{\Sigma(X-\bar{X})^2}{N-1}}$

* The Belt Source is the grab sample from the Sack Source

TABLE 3

EVALUATION OF PECAN NUTS PROCESSED BY A CLEANING MACHINE[a/]
IN THREE SIZES AND THREE SHUCK COVER CATEGORIES
WITH VARIOUS TYPES OF DAMAGE

C[b/]	S[c/]	N[d/]	COLLECTED $\bar{X}$[e/]	COLLECTED S[f/]	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "TEXAS 60" 1976																		
C	M	9	110.1	33.2	5.1	11.2	105.0	35.0	0.1	0.1	0.4	0.0	0.0	0.7	9.5	86.2	0.1	6.4
C	L	9	400.8	273.1	15.9	15.3	384.8	258.4	37.4	109.2	44.1	17.8	9.7	2.6	107.0	130.1	0.0	19.8
C	S	9	51.3	46.3	0.0	0.0	51.3	46.3	0.0	0.0	0.0	0.0	0.0	2.7	6.3	44.7	0.0	7.0
N	M	9	57.8	74.6	32.2	48.3	25.5	27.4	0.2	0.3	8.6	0.1	0.0	0.0	11.1	7.2	19.2	19.2
N	L	9	15640.2	5977.6	13220.0	4384.6	2420.2	2698.5	76.2	9.4	42.0	184.6	0.0	6.2	49.1	40.7	98.4	1896.5
N	S	5	57.2	95.6	29.2	55.2	28.0	43.0	0.0	0.0	0.0	0.0	0.0	0.2	13.6	8.6	2.8	3.0
P	M	9	25.3	28.7	1.1	1.9	24.2	27.8	3.7	0.6	0.1	0.3	0.2	0.8	3.0	15.8	0.4	5.5
P	L	9	172.8	190.0	20.4	27.4	152.3	171.6	19.3	13.4	14.8	2.1	0.3	0.3	29.6	85.8	1.0	22.1
P	S	7	14.0	24.8	0.0	0.0	14.0	24.8	0.0	0.0	0.0	0.0	0.0	0.7	1.0	11.4	0.0	10.0

TABLE 3 (CONTINUED)

C	S	N	COLLECTED $\bar{X}$	COLLECTED S	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "SQUIRREL" 1976																		
C	M	13	187.1	125.3	1.4	2.3	185.6	124.5	0.2	0.0	0.1	0.0	0.8	0.0	33.1	153.2	0.0	8.1
C	L	13	143.3	80.3	1.4	2.4	141.9	79.5	2.7	5.8	0.6	0.3	0.0	0.0	28.6	104.0	0.0	4.1
C	S	13	36.0	18.1	0.4	0.8	35.6	17.8	0.0	0.0	0.0	0.0	0.2	0.0	3.2	32.3	0.0	3.1
N	M	13	316.4	225.7	63.0	50.9	253.3	180.4	16.0	2.9	0.9	1.6	0.0	0.0	92.8	122.0	6.0	35.6
N	L	13	4989.3	1431.6	3966.2	996.3	1023.1	924.8	234.3	81.2	47.6	48.8	0.0	0.6	160.3	294.1	46.4	237.6
N	S	13	21.2	20.7	4.2	5.1	17.0	16.4	0.5	0.3	0.3	1.0	0.0	0.9	8.8	7.6	1.7	4.3
P	M	13	120.6	97.4	4.3	6.3	116.3	92.8	0.6	0.3	0.2	0.0	0.0	0.0	42.6	71.1	0.0	19.0
P	L	13	155.9	136.7	20.3	36.3	135.5	104.5	4.3	6.0	0.9	0.3	0.3	0.0	36.8	88.2	0.3	23.0
P	S	12	9.1	6.0	0.8	2.2	8.3	4.6	0.0	0.0	0.0	0.0	0.0	0.0	2.9	5.0	0.0	3.0

TABLE 3 (CONTINUED)

C	S	N	COLLECTED $\bar{X}$	COLLECTED S	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "TEXAS 60" 1978																		
C	M	10	226.9	138.3	13.9	16.2	213.0	126.3	2.8	0.1	1.8	0.2	1.3	10.8	64.7	133.9	2.4	8.4
C	L	10	428.9	302.7	86.4	76.7	342.5	231.5	6.2	6.8	0.5	3.2	13.8	16.2	124.9	175.8	2.2	9.1
C	S	10	36.5	19.6	0.4	0.7	36.1	19.2	0.0	0.0	0.0	0.0	0.0	1.7	11.2	23.4	0.5	1.0
N	M	10	115.8	183.4	61.5	101.4	54.3	102.2	2.7	0.1	0.0	0.5	0.0	1.0	12.0	4.3	2.4	36.4
N	L	10	14120.7	7128.8	12892.2	6683.3	1228.5	938.5	199.1	14.1	0.0	33.6	1.9	4.5	133.1	7.4	19.0	846.7
N	S	9	3.1	2.4	1.6	1.2	1.5	1.8	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.1	0.5
P	M	10	28.7	36.6	6.3	13.5	22.4	23.7	0.5	0.2	0.0	0.2	0.0	2.4	6.7	14.2	1.7	4.3
P	L	10	152.4	120.2	40.8	34.8	111.6	88.3	4.4	1.6	0.7	0.5	7.7	4.3	45.8	47.0	5.6	12.2
P	S	7	5.0	5.6	0.1	0;3	4.8	5.3	0.1	0.0	0.0	0.0	0.0	0.5	0.8	3.4	0.4	0.5

TABLE 3 (CONTINUED)

C	S	N	COLLECTED $\bar{X}$	COLLECTED S	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "STUART" 1978																		
C	M	10	134.8	43.7	8.3	6.8	126.5	39.7	0.3	0.4	0.1	0.1	1.0	2.5	45.1	78.1	1.0	10.6
C	L	10	954.7	743.9	340.8	491.2	613.9	336.4	30.7	103.1	4.4	2.0	28.5	10.8	338.2	131.7	6.7	12.0
C	S	10	73.4	42.8	0.8	1.4	72.6	42.3	0.0	0.2	0.0	0.0	0.8	0.6	18.1	52.9	0.4	11.5
N	M	9	76.6	61.1	59.5	51.3	17.1	10.8	0.2	0.8	0.0	0.1	0.0	0.7	4.5	5.2	2.1	6.7
N	L	10	8543.4	3971.2	7915.5	3825.3	625.9	528.1	36.1	6.9	0.2	2.4	4.4	0.8	278.1	11.5	1.8	290.4
N	S	8	8.7	11.4	5.7	8.4	3.0	3.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	1.6	0.1	1.5
P	M	10	9.7	6.2	1.5	1.2	8.2	5.2	0.2	0.2	0.0	0.0	0.1	0.2	2.8	4.7	0.3	1.4
P	L	10	276.2	227.9	156.7	191.0	119.5	53.1	5.6	12.2	0.6	2.1	12.9	2.9	51.6	36.1	1.7	14.6
P	S	3	2.3	1.1	0.0	0.0	2.3	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	1.0

TABLE 3 (CONTINUED)

C	S	N	COLLECTED $\bar{X}$	COLLECTED S	GOOD $\bar{X}$	GOOD S	DAMAGED $\bar{X}$	DAMAGED S	WEEVIL PUNCT. $\bar{X}$	WEEVIL HOLES $\bar{X}$	LARVAE PRESENT $\bar{X}$	STINK BUG $\bar{X}$	SHUCK-WORM $\bar{X}$	DISE. $\bar{X}$	SHRIV. KERNEL $\bar{X}$	BLACK KERNEL $\bar{X}$	ANIMAL $\bar{X}$	MECH. $\bar{X}$
CULTIVAR "STUART" 1979																		
C	M	5	137.2	131.3	14.6	16.0	122.6	116.5	0.8	0.4	0.0	0.2	1.0	5.2	59.4	50.0	3.6	11.2
C	L	5	811.0	474.6	383.2	318.2	427.8	201.8	72.0	84.8	6.4	0.0	26.0	16.6	182.2	111.8	3.8	14.6
C	S	5	34.0	38.3	0.9	1.7	33.2	38.7	0.0	0.2	0.0	0.0	0.2	3.8	6.8	20.6	0.6	2.8
N	M	5	41.4	66.4	26.8	46.5	14.6	19.9	1.2	0.4	0.4	0.0	0.0	2.6	3.8	2.0	0.8	3.8
N	L	5	8593.2	2942.8	7692.2	2708.2	901.0	611.3	64.6	6.4	3.4	0.0	9.2	1.8	158.4	106.0	3.4	615.8
N	S	3	5.6	5.5	1.6	1.5	4.0	5.2	0.3	0.0	0.0	0.0	0.0	0.3	1.3	0.6	0.3	1.3
P	M	5	18.4	17.7	3.8	4.7	14.6	13.3	0.0	0.0	0.0	0.0	0.4	2.2	6.8	4.8	0.4	3.2
P	L	5	242.4	188.5	107.6	62.7	134.8	181.1	17.2	19.6	1.0	0.0	1.0	9.4	47.8	28.6	1.6	17.2
P	S	2	1.0	1.4	0.0	0.0	1.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.5

a/ Portable Bowie Cleaner. Noble Foundation, Burneyville, OK

b/ Cover: C = complete shuck cover, N = no shuck cover, P = partial shuck cover

c/ Size: M = medium-sized, L = large-sized, S = small sized

d/ N = No. of trees in sample

e/ $\bar{X} = \Sigma X/N$

f/ $S = \sqrt{\frac{\Sigma(X-\bar{X})^2}{N-1}}$

(2) black kernels - 6% (294/4989); and (3) mechanical damage - 5% (238/4989).

Five percent (299/5978) of the total nuts per tree were in the "large size with complete and partial nut shuck cover" categories (Tables 1 and 2) with 93% (277/299) damaged. The majority of the damage was attributed to: (1) Black kernels - 64% (192/299); and (2) shrivelled kernels - 22% (65/299).

Nuts Processed By a Cleaning Machine

The cleaning process (blowover and hand removal of damaged pecans from the conveyor belt, which were called conveyor belt rejects) removed 25% (1504/5978) of the nuts with the remaining 75% (4475/5978) sacked as market (Table 2).

Blowover

Seven percent (409/5978) of the nuts were blown out in the blowover with 88% (361/509) damaged per tree. The major types of damage were: (1) Black kernels - 57% (233/509); (2) shrivelled kernels - 19% (78/509); and (3) mechanical damage - 19% (78/509).

Conveyor Belt Rejects (Hand Removal)

Eighteen percent (1095/5978) of the nuts were hand removed from the conveyor belt with 90% (988/1095) damaged per tree. The major types of damage were : (1) Black kernels - 58% (520/1095); (2) mechanical damage - 21% (225/1095) and (3) shrivelled kernels - 20% (220/1095).

Marketable Nuts (Sacked)

Marketable nuts were those that remained after the machine cleaning process and this represented 75% (4475/5978) of the nuts with 13% (568/4475) damaged. The primary types of damage were: (1) Pecan weevil - 6% (281/4475); (2) black kernels - 3% (125/4475); and shrivelled kernels - 3% (112/4475).

"Texas 60" Cultivar - 1976 and 1978

Tree Production and Nut Damage

Tables 2, 3 and 4 present a detailed analysis of the pecan nuts with the various types of damage. The average number of nuts produced by this cultivar was 16726 $\pm$ 6153 with 20% (3268/16726) damaged per tree in 1976. The major types of damage were: (1) Mechanical damage - 12% (2010/16726); (2) black kernels - 3% (449/16726); and (3) pecan weevil - 2% (394/16726).

In 1978 the average number of nuts produced per tree was 15287 $\pm$ 7208 with 14% (2129/15287) damaged. The major types of damage were: (1) Mechanical damage - 6% (976/15287); (2) black kernels - 3% (437/15287); and (3) shrivelled kernels - 3% (422/15287).

Nuts by Size and Shuck Cover

In averaging the pecans in the "large size with no shuck" category for 1976 and 1978 this type comprised 93% (14881/16007) of the total number of nuts per tree and represented most of the marketable nuts (Tables 3 and 4). The major types of damage were: (1) Mechanical damage - 9% (1372/14881); and (2) pecan weevil - 1% (171/14881).

Four percent (578/16007) of the total nuts per tree were in the

TABLE 4

MAJOR TYPES OF DAMAGE[a/b/c/] TO THE AVERAGE YIELD FROM "TEXAS 60" CULTIVAR TREES BY SIZE OF NUT AND AMOUNT OF NUT SHUCK COVER BY COMBINING 1976 AND 1978[d/] DATA, NOBLE FOUNDATION RED RIVER FARM, BURNEYVILLE, LOVE COUNTY, OKLAHOMA.

Amount of shuck on the nut	Size of nut (cm)		
	Large (3.3-2.9)	Medium (2.8-2.5)	Small (2.4-1.5)
No shuck			
Collected	14880	87	30
Damaged	12%	46%	49%
Types of damage			
	9% Mechanical	32% Mechanical	23% Shrivelled
	1% Weevil	13% Shrivelled	15% Black
	1% Stinkbug	12% Animal	6% Mechanical
Partial Shuck			
Collected	163	27	10
Damaged	81%	86%	100%
Types of damage			
	41% Black	55% Black	100% Black
	23% Shrivelled	18% Shrivelled	100% Shrivelled
	17% Weevil		
Complete shuck			
Collected	415	168	44
Damaged	88%	95%	100%
Types of damage			
	40% Black	65% Black	77% Black
	27% Shrivelled	22% Shrivelled	20% Shrivelled
	25% Weevil	4% Mechanical	

a/ Percentages rounded to the nearest 1%.
b/ Damage Types: Shrivelled = Shrivelled Kernels, Mechanical = Mechanical damage, Black = Black Kernels, Weevil = Pecan Weevils.
c/ Multiple damage to some pecans caused certain categories to be greater than 100%
d/ 15824 ± 6680 nuts were harvested from the average tree.

"large size with complete and partial nut shuck cover" categories (Tables 2 and 4) with 86% (496/578) damaged. The majority of the damage was attributed to: (1) Black kernels - 38% (219/578); (2) shrivelled kernels - 27% (153/578); and (3) pecan weevil - 22% (129/578). Two percent (366/16007) of the total nuts per tree were in the "medium and small sizes with complete, partial and no shuck" categories with 79% (290/366) damaged. The major types of damage were (1) Black kernels - 58% (117/366); (2) shrivelled kernels - 19% (70/366); and (3) mechanical damage - 14% (51/366).

Nuts Processed by a Cleaning Machine - 1976

The cleaning process (blowover and hand removal of apparently damaged pecans from the conveyor belt) removed 19% (3181/16725) of the nuts with 81% (13544/16725) sacked as marketable.

Blowover

Twelve percent (2020/16725) of the nuts were blown out in the blowover with 35% (700/2020) damaged. The major types of damage were (1) Black kernels - 31% (220/700); (2) mechanical damage - 31% (214/700) and (3) shrivelled kernels - 24% (169/700) (Tables 2 and 3).

Conveyor Belt Rejects (Hand Removal)

Seven percent (1161/16725) of the nuts were hand removed from the conveyor belt with 91% (1059/1161) damaged. The major types of damage were: (1) Mechanical damage - 53% (614/1161); (2) black kernels - 18% (209/1161); and (3) pecan weevil - 14% (168/1161).

Marketable Nuts (Sacked)

The marketable nuts were those that remained after the machine

cleaning process and this represented 81% (13545/16725) 9f the nuts with 11% (1510/13545) damaged (Table 2). The primary types of damage were: (1) Mechanical damage - 77% (1163/1510); (2) stinkbug - 9% (135/1510); and (3) pecan weevil - 7% (103/1510).

Nuts Processed by a Cleaning Machine - 1978

The cleaning process removed 15% (2260/15287) of the nuts with 85% (13027/15287) sacked as marketable.

Blowover

Four percent (548/15287) of the nuts were blown out in the blow-over with 59% (325/548) damaged. The major types of damage were: (1) Black kernels - 28% (156/548); (2) shrivelled kernels - 15% (86/548); and (3) mechanical damage - 13% (70/548) (Tables 2 and 3).

Conveyor Belt Rejects (Hand removal)

Eleven percent (1712/15287) of the nuts were hand removed from the conveyor belt with 67% (1153/1712) damaged. The major types of damage were: (1) Mechanical damage - 33% (570/1712); (2) black kernels - 16% (281/1712); and (3) shrivelled kernels - 13% (226/1712).

Marketable Nuts (Sacked)

Eighty-five percent (13207/15287) of the nuts were marketable with 5% (650/13207) damaged. The major damage types were: (1) Mechanical damage - 3% (336/13207); (2) pecan weevil - 1% (18/13207); and (3) shrivelled kernels - 1% (110/13207).

"Stuart" Cultivar 1978 and 1979

Tree Production and Nut Damage

Tables 2, 3 and 5 present a detailed analysis of the pecan nuts with the various types of damage. The average number of nuts produced by this cultivar was 10079 ± 4310 with 16% (1591/10079) damaged per tree in 1978. The major types of damage were: (1) Shrivelled kernels - 7% (470/10079); (2) mechanical damage - 4% (348/10079); (3) black kernels - 3% (322/10079); and (4) pecan weevil - 2% (203/10079).

In 1979 the average number of nuts produced per tree was 9881 ± 3634 with 17% (1651/9881) damaged. The major types of damage were: (1) Mechanical damage - 7% (671/9881); (2) shrivelled kernels - 5% (466/9881); (3) black kernels - 3% (325/9881); and (4) pecan weevil - 3% (279/9881).

Nuts by Size and Shuck Cover Categories

In averaging the pecans in the "large size with no shuck" category for 1978 and 1979, this type comprised 86% (8668/9980) of the total number of nuts per tree and represented most of the marketable nuts (Tables 3 and 5). The major damage types of this category were (1) Mechanical damage - 5% (453/8568); (2) shrivelled kernels - 3% (218/8568); and (3) pecan weevil - 1% (59/8568). Eleven percent (1142/9880) of the total nuts per tree were in the large size with complete and partial nut shuck cover categories (Tables 2 and 5) with 57% (648/1142) damaged. The majority of the damage was attributed to: (1) Shrivelled kernels - 19% (212/1142); (2) pecan weevil - 16% (177/1142); and (3) black kernels - 14% (154/1142.

Three percent (272/9980) of the total nuts per tree were in the

TABLE 5

MAJOR TYPES OF DAMAGE[a/b/c/] TO THE AVERAGE YIELD FROM "STUART" CULTIVAR TREES BY NUT SIZE AND AMOUNT OF NUT SHUCK COVER BY COMBINING 1978 AND 1979[d/] DATA, NOBLE FOUNDATION RED RIVER FARM, BURNEYVILLE LOVE COUNTY, OKLAHOMA.

Amount of shuck on the nut	Size of nut (cm)		
	Large (3.8-3.0)	Medium (2.9-2.6)	Small (2.5-1.5)
No shuck			
Collected	8568	59	7
Damaged	9%	27%	50%
Types of damage			
	5% Mechanical	9% Mechanical	20% Mechanical
	3% Shrivelled	7% Shrivelled	10% Shrivelled
	1% Weevil		
Partial Shuck			
Collected	259	14	2
Damaged	49%	81%	100%
Types of damage			
	21% Shrivelled	34% Shrivelled	100% Black
	12% Black	33% Black	
	11% Weevil		
Complete Shuck			
Collected	883	136	54
Damaged	59%	91%	98%
Types of damage			
	29% Shrivelled	47% Black	68% Black
	17% Weevil	38% Shrivelled	23% Shrivelled
	14% Black		

a/ Percentage rounded to the nearest 1%.
b/ Damage Types: Shrivelled = Shrivelled Kernels, Mechanical = Mechanical damage, Black = Black Kernels, Weevil = Pecan Weevil.
c/ Multiple damage to some pecans caused certain categories to be greater than 100%.
d/ 8568 ± 3457 nuts were harvested from the average tree.

medium and small sizes with complete, partial and no shuck categories with 77% (210/272) damaged. The major damage types were: (1) Black kernels - 41% (112/272); (2) shrivelled kernels - 27% (74/272); and (3) mechanical damage - 10% (28/272).

Nuts Processed by a Cleaning Machine - 1978

The cleaning process (blowover and hand removal of apparently damaged pecans from the conveyor belt) removed 21% (2095/10079) of the nuts with 77% (7789/10079) sacked as marketable. Two percent (195/10079) were used for tree and ground grab samples (Table 2).

Blowover

Two percent (218/10079) of the nuts were blown out in the blowover with 58% (128/218) damaged. The major types of damage were: (1) Black kernels - 33% (73/218); (2) shrivelled kernels - 17% (318/218); (3) mechanical damage - 10% (22/218); and (4) pecan weevil - 3% (6/218) (Tables 2 and 3).

Conveyor Belt Rejects (Hand Removal)

Nineteen percent (1877/10079) of the nuts were hand removed from the conveyor belt with 60% (1108/1877) damaged. The major types of damage were: (1) Shrivelled kernels - 22% (413/1877); (3) mechanical damage - 16% (306/1877); (3) black kernels - 13% (242/1877); and (4) pecan weevil - 9% (164/1877).

Marketable Nuts

The marketable nuts were those that remained after the machine cleaning process and this represented 77% (7789/10079) of the nuts with 4% (314/7789) damaged (Table 2). The primary types of damage

were: (1) Shrivelled kernels - 3% (264/7789); (2) pecan weevil - 1% (31/7789); and (3) mechanical damage - 1% (20/7789).

Nuts Processed by the Cleaning Machine - 1979

The cleaning process (blowover and hand removal of apparently damaged pecans from the conveyor belt) removed 16% (1619/9881) of the nuts with 83% (8160/9881) sacked as marketable with 1% (102/9881) as the tree grab sample.

Blowover

Four percent (413/9881) of the nuts were blown out in the blow-over with 88% (364/9881) damaged. The major types of damage were: (1) Black kernels - 37% (152/413); (2) mechanical damage - 35% (143/413); and (3) shrivelled kernels - 19% (79/413) (Tables 2 and 3).

Conveyor Belt Rejects (Hand Removal)

Twelve percent (1206/9881) of the nuts were hand removed from the conveyor belt with 55% (663/1206) damaged. The major sources of damage were: (1) Shrivelled kernels - 21% (259/1206); (2) pecan weevil - 17% (204/1206); (3) mechanical damage - 16% (194/1206); and (4) black kernels - 7% (79/1206).

Marketable Nuts

The marketable nuts were those that remained after the machine cleaning process and this represented 83% (8160/9881) of the nuts with 8% (618/8160) damaged (Table 2). The primary types of damage were: (1) Mechanical damage - 4% (333/8160); (2) shrivelled kernels - 2% (124/8160); and (3) black kernels - 1% (93/8160).

CHAPTER IV

DISCUSSION

The results, separation of harvested nuts by the cleaning process (separating the nuts into three sources: (1) blowover; (2) conveyor belt rejects; and (3) marketable nuts) and evaluation of the nuts for damage, showed high variation of damage from tree to tree, cultivar to cultivar, and year to year.

The setting of the machine has a direct effect on the number of nuts that are removed by blowover, conveyor belt rejects (hand removed), and the remaining marketable (sacked) nuts. If the nuts are subjected to a lot of air (vacuum) many good marketable nuts can be lost in the blowover. However, if the nuts are subjected to a small amount of air (vacuum) more damaged nuts occur on the conveyor belt, which requires more laborers to remove these damaged nuts, and most likely, the precision of removing bad nuts would be lowered. In some instances it would be wise to reprocess the nuts discarded as blowover and conveyor belt rejects to retrieve many of the good nuts. Machine and human error play a major role in separating the good and bad nuts. Constant vigilance is needed as different trees and cultivars from different parts of the orchard are cleaned. Many times trees of the same cultivar but grown in different areas of the orchard had nuts that were good but were small and light in weight. Thus, these good nuts could go undetected and be lost in the blowover.

The removal of damaged nuts from the conveyor belt requires constant alertness and if unremoved become part of the marketable (sacked) nuts. The damaged nuts that were not detected on the conveyor belt represented approximately 8% of the marketable nuts. Only those nuts that showed external defects (insect, disease, mechanical, physiological or environmental damage) were removed and discarded. Many nuts with partial shuck or complete were removed from the conveyor belt contained good kernels. The nuts with some shuck cover should be processed in a manner where the good nuts can be detected. Further research in this area is needed because of the quantity of good nuts of this type discarded, with the "Stuart" cultivar. Tables 3 and 5 show the large number of the "Stuart" nuts in the "large size with partial shuck cover" that contained good kernels, but were discarded. There are several reasons why the shuck may stick to the good pecan. Environmental and physiological stresses, insects or diseases can prevent the development of the nut and shuck split (Finch and VanHorn 1936). Most of the other medium and smaller size nuts with some shuck were damaged.

Weevil damage presented in Table 2 and 3 showed just the amount of direct vision effect (feeding on kernel, weevil exit holes, presence of larvae). However, weevil damage can be confused with other types of damage. The shrivelled and black kernel categories is an example of damage that can be caused by many factors.

If adult weevil activity occurs while the nut is still in the "water stage" (endosperm is noncellular), premature nut drop can occur. These nuts are usually medium to large in size

with the shuck cover remaining. When reviewing the ground grab sample, the nuts of this type were found to have shrivelled and black kernels. If the pecan weevil punctured the nut in the "gel" or "dough" stage, the shuck frequently remained around the pecan whether the kernel is good or damaged.

Nut loss due to shuckworm and stinkbug was minimal. However, the shrivelled and black kernel categories possessed some of these types of insect. Premature nut drop and improper nut development are damages the shuckworm and stinkbug can cause. Stinkbug feeding can be confused with weevil feeding (the visual effect). This confusion factor should be investigated.

The Pecan nuts that were observed to have disease were not identified at this time. This type of damage was mostly in the large size class with a type of shuck present (Table 3). Again, a portion of nuts that had a disease could be in the black and shrivelled categories.

Animal damage is difficult to evaluate and estimate because the animal (blue jays and crows) carry away a portion of the crop. The visual effect that we evaluated was minimal but other studies have shown that the total crop can be lost to wild animals.

Mechanical damage observed in 1976 was extremely high. Restriction of people, cars, etc. were limited into the orchard to prevent this damage but two years later this type of damage was lowered but still a large number of nuts were damaged. A large number of nuts with good kernel were discarded as a result of mechanical damage. Decreasing mechanical damage will increase the amount of good marketable nuts.

The majority of nuts damaged had shrivelled and black kernels. It was difficult or impossible to determine to what degree those nuts with black and shrivelled kernels were due to insect, disease, or environmental and physiological damage in this study.

Because we can only see the effect of the damage and not the cause it makes it is difficult to determine which damage causes the nut to blacken or shrivel.

A tree and ground grab sample were taken for the "Stuart" cultivar before the initial harvest. The tree grab sample had ca. 5% damage in 1978 and 1979. Most of the damaged pecans had shrivelled kernels and the presence of weevil was evident. The ground grab shwoed a variety of damage types and had ca. 35% damage.

Based upon this study it appears that management of pecans for nut production is in its infancy. Many problems and questions need answering before maximum productivity is reached, such as, what causes the black and shrivelled kernels, how can mechanical damage to the nuts be prevented, what would be the effect on the tree of "perfect" pest management with the increased yield, how can you determine and what is the maximum yield a tree can support from year to year? These and other questions can be answered best with future studies including integration of researchers in the fields of: Horticulture, Plant Pathology, Entomology, Agricultural Engineering, Agricultural Economics, Statistics and Soils. Most if not all of the pecan growers in Oklahoma will have 50% of their crop damaged or lost from July on through the season prior to selling the nuts. This loss appears exorbitant and wasteful and can be reduced.

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APPENDIX A

NUTS PROCESSED BY A CLEANING MACHINE WITH VARIOUS TYPES OF DAMAGE DATA FOR 1976 "SQUIRREL" CULTIVAR

1976 "SQUIRREL" APPENDIX A CODE

YR = Year
SQ = Squirrel Cultivar
SOURCES = Separation of nuts on the cleaning machine
BELT = Sample selected from the sack
BLOW = Nuts subjected to air flow
CONV = Hand removal of rejected nuts
COVER = Amount of shuck
  N = No shuck
  P = Partial shuck
  C = Complete Shuck
MATURITY = Nut size
  M = Large
  I = Medium
  Y = Small
COLLECT = Total nuts
GOOD PROJ = Good nuts
WVLC PROJ = Nuts punctured by the pecan weevil
HOLS PROJ = Larva exit holes
GRUB PROJ = Presence of Larva
STNK PROJ = Nuts punctured by the stinkbug
SHKW PROJ = Nuts damaged by shuckworm
SHRI PROJ = Nuts with shrivelled kernels
BLAK PROJ = Nuts with black kernels
DISE PROJ = Diseased nuts
ANIMR POJ = Animal damage
MECHR POJ = Mechanical damage

PLOTS=HALL YR=75 VARIETY=SQ TREE=2

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	355	330	7	4	7	4	0	7	4	0	0	0
BLOW	C	I	120	6	0	0	0	0	0	8	105	0	0	2
BLOW	C	M	60	0	0	0	0	0	1	4	56	0	0	2
BLOW	C	Y	32	2	0	0	0	0	0	2	23	0	0	4
BLOW	N	I	109	20	2	0	0	0	0	55	33	0	0	8
BLOW	N	M	228	77	12	4	0	0	0	54	66	0	4	41
BLOW	N	Y	5	2	0	0	0	0	0	1	2	0	0	0
BLOW	P	I	62	0	0	0	0	0	0	27	18	0	0	20
BLOW	P	M	43	2	0	0	0	0	0	7	34	0	1	10
BLOW	P	Y	5	0	0	0	0	0	0	2	3	0	0	1
CONV	C	I	51	1	0	0	0	0	0	9	41	0	0	1
CONV	C	M	19	0	0	3	0	0	0	5	11	0	0	1
CONV	C	Y	15	1	0	0	0	0	0	4	10	0	0	4
CONV	N	I	341	86	18	11	0	0	0	136	86	0	4	11
CONV	N	M	402	134	12	59	8	0	0	51	28	4	24	102
CONV	N	Y	4	2	0	0	0	0	0	1	1	0	0	0
CONV	P	I	29	5	0	0	0	0	0	10	14	0	0	0
CONV	P	M	18	7	2	0	0	0	0	7	2	0	0	1
CONV	P	Y	8	0	0	0	0	0	0	2	6	0	0	2
SACT	N	M	3931	3659	78	39	78	39	0	78	39	0	0	0

PLOTS=HALL YR=76 VARIETY=SQ TREE=3

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	197	173	5	0	2	3	0	5	3	0	0	0
BLOW	C	I	30	0	0	0	0	0	0	0	30	0	0	4
BLOW	C	M	20	0	0	0	0	0	0	0	20	0	0	1
BLOW	C	Y	4	0	0	0	0	0	0	0	4	0	0	0
BLOW	N	I	16	2	0	0	0	0	0	8	5	0	0	3
BLOW	N	M	46	25	0	0	0	1	0	8	11	0	0	9
BLOW	P	I	5	0	0	0	0	0	0	0	5	0	0	0
BLOW	P	M	20	0	0	0	0	0	0	4	16	0	0	6
BLOW	P	Y	2	0	0	0	0	0	0	0	2	0	0	0
CONV	C	I	79	0	0	0	0	0	1	4	75	0	0	12
CONV	C	M	102	0	0	1	0	0	0	13	88	0	0	12
CONV	C	Y	42	0	0	0	0	0	1	0	42	0	0	7
CONV	N	I	245	68	66	0	0	0	0	18	56	0	13	15
CONV	N	M	445	54	18	5	0	0	0	27	327	0	0	254
CONV	N	Y	10	1	1	0	0	0	0	1	5	0	1	0
CONV	P	I	7	0	0	0	0	0	0	0	7	0	0	2
CONV	P	M	62	6	1	1	0	0	0	5	49	0	0	15
CONV	P	Y	2	0	0	0	0	0	0	0	2	0	0	0
SACT	N	M	3580	3211	74	0	37	37	0	111	37	0	0	0

PLOTS=HALL YR=76 VARIETY=SQ TREE=--

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HTLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	420	381	9	0	4	4	0	22	4	0	0	0
BLOW	C	I	82	0	0	0	0	0	0	28	54	0	0	0
BLOW	C	M	86	9	1	1	1	0	0	26	50	0	0	0
BLOW	C	Y	14	0	0	0	0	0	0	2	12	0	0	0
BLOW	N	I	120	46	0	0	0	1	0	49	20	0	0	11
BLOW	N	M	245	82	8	5	0	0	0	90	47	0	11	29
BLOW	P	I	54	0	0	0	0	0	0	23	31	0	0	11
BLOW	P	M	61	3	1	0	0	0	0	14	43	0	0	13
CONV	C	I	61	0	0	0	2	0	0	23	36	0	0	4
CONV	C	M	97	0	0	6	1	0	0	41	50	0	0	1
CONV	C	Y	20	0	0	0	0	0	0	6	14	0	0	0
CONV	N	I	556	126	34	0	0	15	0	228	95	0	0	69
CONV	N	M	446	44	3	72	0	0	0	23	52	0	15	263
CONV	N	Y	26	5	0	0	0	0	0	16	3	0	2	0
CONV	P	I	36	1	1	0	0	0	0	26	7	0	0	4
CONV	P	M	55	11	2	6	2	2	0	13	22	0	0	1
CONV	P	Y	23	3	0	0	0	0	0	8	8	0	0	0
SACT	N	M	5195	4708	108	0	54	54	0	271	54	0	0	0

PLOTS=HALL YR=76 VARIETY=SQ TREE=6

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HTLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	382	208	102	0	0	0	0	8	61	0	0	8
BLOW	C	I	111	3	1	0	0	0	2	6	117	0	0	0
BLOW	C	M	96	1	2	2	0	0	0	17	74	0	0	2
BLOW	C	Y	30	0	0	0	0	0	1	0	30	0	0	0
BLOW	N	I	252	46	5	8	0	0	0	24	177	0	0	13
BLOW	N	M	527	90	21	58	0	11	0	63	290	0	0	169
BLOW	N	Y	29	8	1	0	0	1	0	6	13	0	0	5
BLOW	P	I	35	0	0	1	0	0	0	6	28	0	0	13
BLOW	P	M	73	3	2	6	0	0	3	21	41	0	0	12
BLOW	P	Y	3	0	0	0	0	0	0	0	2	0	0	2
CONV	C	I	242	3	1	0	0	0	3	15	221	0	0	13
CONV	C	M	176	1	3	4	1	0	0	27	141	0	0	11
CONV	C	Y	23	0	0	0	0	0	1	0	23	0	0	2
CONV	N	I	520	92	15	14	3	3	0	73	320	0	3	60
CONV	N	M	595	63	24	69	0	9	0	42	227	0	36	256
CONV	N	Y	50	12	2	4	4	13	0	21	30	12	15	21
CONV	P	I	80	0	0	0	0	1	0	13	63	0	0	28
CONV	P	M	143	10	4	0	0	0	1	37	84	0	0	20
CONV	P	Y	3	0	0	0	0	0	0	0	2	0	0	2
SACT	N	M	6037	3287	1614	0	0	0	0	120	956	0	0	120

PLOTS=HALL YR=75 VARIETY=SQ TREE=7

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	507	475	13	5	5	8	0	3	3	0	0	0
BLOW	C	I	89	0	0	0	0	0	0	7	82	0	0	2
BLOW	C	M	20	0	0	0	0	0	0	1	19	0	0	0
BLOW	C	Y	10	0	0	0	0	0	0	0	10	0	0	0
BLOW	N	I	45	3	1	0	0	0	0	21	20	0	0	7
BLOW	N	M	64	18	1	0	1	0	0	8	27	0	3	23
BLOW	N	Y	1	0	0	0	0	0	0	0	1	0	0	0
BLOW	P	I	53	3	0	0	0	0	0	26	24	0	0	7
BLOW	P	M	29	0	1	0	0	0	0	1	27	0	0	11
BLOW	P	Y	3	0	0	0	0	0	0	2	2	0	0	0
CONV	C	I	159	0	0	0	0	0	5	15	144	0	0	12
CONV	C	M	102	1	2	5	0	0	0	24	70	0	0	4
CONV	C	Y	14	0	0	0	0	0	0	1	13	0	0	0
CONV	N	I	353	47	24	0	5	0	0	63	182	0	18	24
CONV	N	M	495	13	0	89	0	0	0	6	45	0	155	214
CONV	N	Y	8	2	0	0	0	0	0	0	6	0	0	0
CONV	P	I	158	3	3	0	0	0	0	30	123	0	0	30
CONV	P	M	170	17	0	12	0	0	0	26	113	0	2	20
CONV	P	Y	1	0	0	0	0	0	0	0	1	0	0	1
SACT	N	M	5984	5606	157	63	63	94	0	31	31	0	0	0

PLOTS=HALL YR=75 VARIETY=SQ TREE=8

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	598	544	12	0	6	12	0	6	24	0	6	0
BLOW	C	I	36	0	1	0	0	0	0	3	32	0	0	0
BLOW	C	M	12	0	0	0	0	0	0	8	4	0	0	0
BLOW	C	Y	14	0	0	0	0	0	0	2	12	0	0	0
BLOW	N	I	28	5	1	0	0	0	0	7	15	0	0	10
BLOW	N	M	49	17	1	1	0	0	0	7	23	0	0	20
BLOW	N	Y	5	1	0	0	0	0	0	1	3	0	0	3
BLOW	P	I	33	0	0	0	0	0	0	7	26	0	0	1
BLOW	P	M	7	0	0	0	0	0	0	0	7	0	0	1
BLOW	P	Y	3	0	0	0	0	0	0	3	0	0	0	0
CONV	C	I	65	2	0	0	0	0	0	5	58	0	0	0
CONV	C	Y	14	0	0	0	0	0	0	2	12	0	0	0
CONV	N	I	68	19	5	0	1	0	0	10	34	0	0	3
CONV	N	M	778	3	16	16	3	3	0	65	497	0	41	155
CONV	N	Y	1	0	1	0	0	0	0	0	0	0	0	0
CONV	P	I	14	1	1	0	0	0	0	5	7	0	0	0
CONV	P	M	218	13	7	11	2	2	0	79	108	0	0	0
SACT	N	M	4001	3641	80	0	40	80	0	40	160	0	40	0

PLOTS=HALL YR=76 VARIETY=SQ TREE=9

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	346	304	11	0	7	0	0	17	4	0	0	10
BLOW	C	I	106	1	0	0	0	0	0	5	100	0	0	10
BLOW	C	M	52	1	0	2	0	0	0	4	44	0	0	6
BLOW	C	Y	13	0	0	0	0	0	0	0	13	0	0	2
BLOW	N	I	44	5	2	0	0	0	0	18	19	0	0	9
BLOW	N	M	50	14	3	2	0	0	0	5	17	0	8	14
BLOW	N	Y	6	1	0	0	0	0	0	1	4	0	0	4
BLOW	P	I	31	0	0	0	0	0	0	4	27	0	0	9
BLOW	P	M	23	0	0	0	0	0	0	0	23	0	0	13
BLOW	P	Y	6	0	1	0	1	0	0	0	5	0	0	1
CONV	C	I	100	0	0	0	0	0	0	9	91	0	0	6
CONV	C	M	100	1	2	4	1	0	0	22	71	0	0	0
CONV	C	Y	41	1	1	0	0	0	0	4	35	0	1	2
CONV	N	I	100	33	3	0	0	0	0	24	37	0	0	25
CONV	N	M	100	3	3	12	1	0	0	2	9	0	41	37
CONV	N	Y	14	6	1	0	0	0	0	1	6	0	0	3
CONV	P	I	71	6	0	0	0	0	0	21	44	0	0	12
CONV	P	M	86	11	4	9	1	0	0	15	45	0	1	15
CONV	P	Y	6	1	0	0	0	0	0	0	4	0	0	4
SACT	N	M	4984	4385	157	0	105	0	0	249	52	0	0	149

PLOTS=HALL YR=76 VARIETY=SQ TREE=10

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	308	268	11	0	9	9	0	17	3	0	0	0
BLOW	C	I	75	0	0	0	0	0	0	11	64	0	0	5
BLOW	C	M	94	0	2	2	0	0	0	18	72	0	0	1
BLOW	C	Y	14	0	0	0	0	0	0	2	12	0	0	3
BLOW	N	I	130	21	6	0	0	1	0	54	44	0	2	10
BLOW	N	M	417	0	8	88	4	0	0	21	55	0	101	185
BLOW	N	Y	5	1	0	0	0	0	0	4	0	0	0	1
BLOW	P	I	34	1	0	0	0	0	0	8	25	0	0	6
BLOW	P	M	55	7	2	2	0	0	0	12	32	0	0	8
BLOW	P	Y	2	0	0	0	0	0	0	1	1	0	0	2
CONV	C	I	179	0	0	0	0	0	0	33	146	0	0	6
CONV	C	M	195	1	7	5	0	1	0	33	149	0	0	1
CONV	C	Y	44	0	0	0	0	0	0	5	39	0	0	6
CONV	N	I	315	41	12	0	0	1	0	110	128	0	9	40
CONV	N	M	398	14	6	75	4	0	0	27	52	0	87	155
CONV	N	Y	15	5	0	0	0	0	0	5	3	0	0	3
CONV	P	I	83	1	0	0	0	0	0	41	41	0	0	15
CONV	P	M	156	15	8	3	4	0	0	48	82	0	0	15
CONV	P	Y	13	0	0	0	0	0	0	1	12	0	0	12
SACT	N	M	4704	4094	174	0	131	131	0	261	44	0	0	0

PLOTS=ALL YR=76 VARIETY=SQ TREE=11

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRJBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	398	386	4	0	0	0	0	0	0	0	0	8
BLOW	C	I	80	0	0	0	0	0	0	5	75	0	1	7
BLOW	C	M	55	0	0	0	0	0	0	2	52	0	0	2
BLOW	C	Y	13	0	0	0	0	0	0	1	12	0	0	0
BLOW	N	I	71	3	1	0	0	0	0	20	43	0	2	12
BLOW	N	M	75	16	1	3	0	0	0	19	30	0	2	27
BLOW	N	Y	5	0	0	0	0	0	0	2	3	0	0	3
BLOW	P	I	40	1	0	0	0	0	0	9	30	0	0	4
BLOW	P	M	26	2	0	0	0	0	0	1	23	0	0	11
BLOW	P	Y	6	0	0	0	0	0	0	4	2	0	0	1
CONV	C	I	61	1	0	0	0	0	0	4	55	0	0	1
CONV	C	M	42	1	3	2	1	1	0	8	26	1	0	1
CONV	C	Y	8	0	0	0	0	0	0	0	8	0	0	1
CONV	N	I	275	89	8	0	3	0	0	70	85	0	11	24
CONV	N	M	102	1	1	26	2	0	0	9	15	0	6	54
CONV	N	Y	2	0	1	0	0	0	0	0	1	0	0	0
CONV	P	I	26	1	0	0	0	0	0	12	12	0	0	7
CONV	P	M	44	7	4	6	0	0	0	7	20	0	0	6
SACT	N	M	2738	2657	27	0	0	0	0	0	0	0	0	54

PLOTS=ALL YR=76 VARIETY=SQ TREE=12

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRJBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	301	270	6	0	3	3	0	6	3	0	0	0
BLOW	C	I	56	2	0	0	0	0	0	15	39	0	0	0
BLOW	C	M	16	0	0	0	0	0	0	4	12	0	0	0
BLOW	C	Y	18	1	0	0	0	0	0	3	14	0	0	0
BLOW	N	I	24	2	1	0	0	0	0	12	7	0	0	10
BLOW	N	M	41	4	2	0	1	0	0	5	22	0	0	26
BLOW	N	Y	6	1	0	0	0	0	0	5	0	0	0	1
BLOW	P	I	27	0	0	0	0	0	0	17	10	0	0	5
BLOW	P	M	41	0	0	0	0	0	0	2	39	0	0	24
BLOW	P	Y	5	0	0	0	0	0	0	1	4	0	0	3
CONV	C	I	434	0	0	0	0	0	0	188	246	0	0	0
CONV	C	M	200	0	2	7	0	0	0	16	175	0	0	0
CONV	C	Y	42	0	0	0	0	0	0	8	34	0	0	0
CONV	N	I	117	9	0	0	0	0	0	68	30	0	3	25
CONV	N	M	384	25	4	111	2	0	0	35	150	0	6	157
CONV	N	Y	42	2	0	0	0	0	0	33	7	0	0	8
CONV	P	I	290	6	2	0	2	0	0	146	135	0	0	19
CONV	P	M	505	140	0	12	0	0	0	140	220	0	0	80
CONV	P	Y	2	1	0	0	0	0	0	0	1	0	0	1
SACT	N	M	2912	2612	60	0	30	30	0	60	30	0	0	0

PLOTS=ALL YR=76 VARIETY=SQ TREE=13

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	I	291	276	6	3	0	3	0	0	3	0	0	0
BLOW	C	I	25	0	0	0	0	0	0	5	20	0	0	3
BLOW	C	M	4	0	0	0	0	0	0	1	3	0	0	0
BLOW	C	Y	9	0	0	0	0	0	0	0	9	0	0	5
BLOW	N	I	12	0	0	0	0	0	0	2	10	0	1	4
BLOW	N	M	13	3	2	0	0	0	0	2	2	0	0	6
BLOW	N	Y	2	0	0	0	0	0	0	1	1	0	0	0
BLOW	P	I	16	1	0	0	0	0	0	2	13	0	0	4
BLOW	P	M	4	0	0	0	0	0	0	0	4	0	0	2
CONV	C	I	95	0	0	0	0	0	0	18	77	0	0	3
CONV	C	M	156	3	6	17	3	0	0	25	102	0	0	6
CONV	C	Y	19	1	0	0	0	0	0	0	18	0	0	3
CONV	N	I	214	24	0	2	0	0	0	99	65	0	6	41
CONV	N	M	238	7	5	62	7	0	0	15	35	0	4	127
CONV	N	Y	18	3	0	0	0	0	0	11	3	0	0	0
CONV	P	I	289	23	0	0	0	0	0	104	162	0	0	35
CONV	P	M	132	7	17	2	2	0	0	24	83	0	0	5
CONV	P	Y	13	0	0	0	0	0	0	9	2	0	0	5
SACT	N	M	3861	3668	77	39	0	39	0	0	39	0	0	0

PLOTS=ALL YR=76 VARIETY=SQ TREE=14

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	282	259	0	3	0	0	0	9	3	0	0	9
BLOW	C	I	18	0	0	0	0	0	0	2	16	0	0	4
BLOW	C	M	2	0	0	0	0	0	0	0	2	0	0	0
BLOW	C	Y	1	0	0	0	0	0	0	0	1	0	0	0
BLOW	N	I	11	5	0	0	0	0	0	1	4	0	0	2
BLOW	N	M	29	3	2	0	1	0	0	5	7	0	1	17
BLOW	N	Y	3	0	0	0	0	0	0	1	2	0	0	3
BLOW	P	I	24	1	0	0	0	0	0	2	21	0	0	3
BLOW	P	M	4	0	0	0	0	0	0	0	4	0	0	0
BLOW	P	Y	2	0	0	0	0	0	0	1	1	0	0	0
CONV	C	I	28	0	0	0	0	0	0	12	16	0	0	0
CONV	C	M	79	0	4	1	1	1	0	45	28	0	0	0
CONV	C	Y	6	0	0	0	0	0	0	0	5	0	0	1
CONV	N	I	65	13	0	0	0	0	0	21	26	0	0	14
CONV	N	M	100	8	0	9	0	0	0	11	63	5	0	42
CONV	N	Y	7	1	0	0	0	0	0	2	2	0	0	2
CONV	P	I	23	1	0	0	0	0	0	14	8	0	0	2
CONV	P	M	19	1	0	1	1	0	0	5	12	0	0	2
CONV	P	Y	2	0	0	0	0	0	0	1	1	0	0	0
SACT	N	M	3124	2864	0	33	0	0	0	98	33	0	0	98

PLOTS=HALL YR=76 VARIETY=SQ TREE=15

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	318	293	11	0	0	7	0	4	4	0	0	0
BLOW	C	I	27	0	0	0	0	0	0	1	25	0	0	5
BLOW	C	M	12	0	0	2	0	0	0	1	9	0	0	1
BLOW	C	Y	4	0	0	0	0	0	0	0	4	0	0	0
BLOW	N	I	45	10	1	2	0	0	0	9	21	0	2	7
BLOW	N	M	120	49	3	6	2	0	0	18	39	0	3	29
BLOW	N	Y	2	1	0	0	0	0	0	0	1	0	0	0
BLOW	P	I	28	1	1	0	1	0	0	2	24	0	0	6
BLOW	P	M	13	0	0	1	0	0	0	3	9	0	0	6
CONV	C	I	24	0	0	0	0	0	0	0	24	0	0	6
CONV	C	M	67	0	2	12	0	2	0	27	25	0	0	2
CONV	C	Y	5	0	0	0	0	0	0	0	5	0	0	0
CONV	N	I	38	5	3	3	0	0	0	7	14	0	5	7
CONV	N	M	304	3	6	95	3	0	0	14	57	0	9	181
CONV	N	Y	10	1	0	0	0	0	0	2	2	0	4	0
CONV	P	I	20	0	0	2	0	0	0	0	20	0	0	5
CONV	P	M	20	3	2	0	0	0	0	8	7	0	0	2
SACT	N	M	2417	2227	81	0	0	54	0	27	27	0	0	0

APPENDIX B

NUTS PROCESSED BY A CLEANING MACHINE WITH VARIOUS TYPES OF DAMAGE DATA FOR 1976 "TEXAS 60" CULTIVAR

1976 "TEXAS 60" APPENDIX B CODE

YR = Year
TX = Texas 60 Cultivar
SOURCES = Separation of nuts on the cleaning machine
BELT = Sample selected from the sack
BLOW = Nuts subjected to air flow
CONV = Hand removal of rejected nuts
COVER = Amount of shuck
  N = No shuck
  P = Partial shuck
  C = Complete shuck
MATURITY = Nut size
  M = Large
  I = Medium
  Y = Small
COLLECT = Total nuts
GOOD PROJ = Good nuts
WVLC PROJ = Nuts punctured by the pecan weevil
HOLS PROJ = Larva exit holes
GRUB PROJ = Presence of Larva
STNK PROJ = Nuts punctured by the stinkbug
SHKW PROJ = Nuts damaged by shuckworm
SHRI PROJ = Nuts with shrivelled kernels
BLAK PROJ = Nuts with black kernels
DISE PROJ = Diseased nuts
ANIMR POJ = Animal damage
MECHR POJ = Mechanical damage

PLOTS=GROV YR=76 VARIETY=TX TREE=1

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	300	188	0	0	0	0	0	0	0	0	0	113
BLOW	C	I	150	4	0	0	0	0	0	16	130	0	0	14
BLOW	C	M	391	12	55	86	43	4	0	141	98	0	0	8
BLOW	C	Y	28	0	0	0	0	0	0	0	28	0	0	2
BLOW	N	I	40	20	0	0	0	0	0	12	3	0	1	4
BLOW	N	M	5275	4344	0	52	0	313	0	52	0	52	52	365
BLOW	N	Y	2	1	0	0	0	0	0	0	1	0	0	0
BLOW	P	I	25	3	0	0	0	0	0	4	18	0	0	5
BLOW	P	M	143	9	20	17	14	3	0	17	76	0	0	23
BLOW	P	Y	1	0	0	0	0	0	0	1	0	0	0	0
CONV	C	I	19	0	0	1	0	0	0	1	17	0	0	1
CONV	C	M	46	3	16	13	13	1	0	8	6	0	0	0
CONV	C	Y	19	0	0	0	0	0	0	0	19	0	0	2
CONV	N	I	11	4	0	0	0	1	0	0	2	0	2	2
CONV	N	M	1150	12	0	0	0	0	0	0	0	0	0	1139
CONV	P	I	1	1	0	0	0	0	0	0	0	0	0	0
CONV	P	M	20	8	10	0	8	2	0	0	0	0	0	1
SACT	N	M	18490	11556	0	0	0	0	0	0	0	0	0	6934

PLOTS=GROV YR=76 VARIETY=TX TREE=2

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	303	270	9	0	3	15	0	0	3	0	0	9
BLOW	C	I	102	0	0	0	0	0	0	10	92	0	0	5
BLOW	C	M	315	16	22	60	14	9	0	135	81	0	0	8
BLOW	C	Y	10	0	0	0	0	0	0	1	9	0	0	2
BLOW	N	M	1653	1281	17	0	8	58	0	91	33	0	50	141
BLOW	N	Y	18	18	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	7	0	0	0	0	0	0	1	6	0	0	3
BLOW	P	M	84	2	3	6	3	2	0	17	54	0	0	9
CONV	C	I	30	1	0	0	0	0	0	2	27	0	0	0
CONV	C	M	732	37	52	291	90	105	0	120	202	7	0	0
CONV	C	Y	10	0	0	0	0	0	0	0	10	0	0	0
CONV	N	I	6	4	1	0	0	0	0	0	0	0	0	1
CONV	N	M	771	0	15	0	0	8	0	0	0	0	23	732
CONV	P	M	29	7	6	6	5	6	0	1	4	0	0	1
CONV	P	Y	4	0	0	0	0	0	0	0	4	0	0	4
SACT	N	M	12126	10792	364	0	121	606	0	0	121	0	0	364

PLOTS=GROV YR=76 VARIETY=TX TREE=3

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	500	490	0	0	0	0	0	0	0	0	0	10
BLOW	C	I	54	0	0	0	0	0	0	27	27	0	0	0
BLOW	C	M	300	0	81	81	81	0	81	138	0	0	0	0
BLOW	N	I	27	27	0	0	0	0	0	0	0	0	0	0
BLOW	N	M	3500	2876	0	0	0	0	0	0	0	0	0	624
BLOW	P	M	350	76	0	0	0	0	0	137	137	0	0	0
CONV	C	I	19	2	0	0	0	0	0	7	10	0	0	1
CONV	C	M	100	20	11	41	13	0	1	27	23	0	0	1
CONV	C	Y	14	0	0	0	0	0	0	5	9	0	0	0
CONV	N	I	11	5	0	0	0	0	0	3	0	0	0	4
CONV	N	M	596	208	0	0	0	0	0	0	0	0	8	381
CONV	P	I	2	1	0	0	0	0	0	1	0	0	0	0
CONV	P	M	20	12	4	2	3	0	0	1	1	0	0	0
SACT	N	M	14620	14325	0	0	0	0	0	0	0	0	0	295

PLOTS=GROV YR=76 VARIETY=TX TREE=4

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	306	300	3	0	3	3	0	0	0	0	0	0
BLOW	C	I	78	2	1	0	0	0	0	9	64	6	0	2
BLOW	C	M	100	2	5	59	6	1	6	24	11	0	0	4
BLOW	N	I	67	36	0	2	2	0	0	16	4	0	14	2
BLOW	N	M	1200	867	24	24	0	12	0	166	59	0	48	83
BLOW	N	Y	39	0	0	0	0	0	0	39	0	0	0	0
BLOW	P	I	74	5	6	6	1	3	2	18	34	8	2	9
BLOW	P	M	65	5	5	22	3	0	3	16	17	3	1	6
BLOW	P	Y	16	0	0	0	0	0	0	5	11	5	0	7
CONV	C	I	19	0	0	0	0	0	0	3	16	0	0	0
CONV	C	M	240	15	10	113	30	13	0	43	68	3	0	5
CONV	C	Y	22	0	0	0	0	0	0	1	21	0	0	4
CONV	N	I	5	3	0	1	0	0	0	1	4	0	0	1
CONV	N	M	927	0	19	0	9	0	0	28	0	0	139	751
CONV	P	M	13	3	3	3	3	0	0	3	0	0	0	1
SACT	N	M	16340	16013	163	0	163	163	0	0	0	0	0	0

PLOTS=GROV YR=75 VARIETY=TX TREE=6

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLGPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	100	84	0	0	0	0	0	0	0	0	0	11
BLOW	C	I	7	0	0	0	0	0	0	0	7	0	0	2
BLOW	C	M	55	2	5	15	8	0	0	17	16	0	0	0
BLOW	N	I	3	1	0	0	0	0	0	0	1	0	0	2
BLOW	N	M	141	55	0	3	0	0	0	0	1	0	0	82
BLOW	N	Y	1	0	0	0	0	0	0	1	0	0	0	1
BLOW	P	M	9	1	1	0	1	1	0	0	7	0	0	4
CONV	C	I	100	35	0	0	1	0	0	3	59	0	1	2
CONV	C	M	240	7	0	71	29	14	0	69	105	10	0	7
CONV	C	Y	153	0	0	0	0	0	0	0	151	0	0	45
CONV	N	I	245	155	0	0	0	0	0	41	8	0	8	41
CONV	N	M	1350	54	0	0	0	14	0	0	27	0	122	1134
CONV	N	Y	225	127	0	0	0	0	0	28	42	0	14	14
CONV	P	I	9	0	0	0	0	0	0	0	9	0	0	2
CONV	P	M	583	37	111	58	80	0	0	53	313	0	5	95
CONV	P	Y	69	0	0	0	0	0	0	0	58	0	0	58
SACT	N	M	17802	14991	0	0	0	0	0	0	0	0	0	1874

PLOTS=GROV YR=76 VARIETY=TX TREE=7

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLGPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	462	451	2	0	2	6	0	0	2	0	0	2
CONV	C	I	65	1	0	0	0	0	0	0	64	0	0	0
CONV	C	M	200	9	0	0	0	0	0	0	187	4	0	0
CONV	C	Y	19	0	0	0	0	0	0	0	19	0	0	0
CONV	N	I	18	2	1	0	0	0	0	0	3	0	13	0
CONV	N	M	520	7	4	0	0	0	0	0	18	4	344	143
CONV	N	Y	1	0	0	0	0	0	0	0	0	1	0	0
CONV	P	I	18	0	3	0	0	0	0	0	13	0	2	0
CONV	P	M	19	5	0	0	0	0	0	0	14	0	0	0
CONV	P	Y	1	0	0	0	0	0	0	0	1	0	0	0
SACT	N	M	16684	16283	57	0	57	229	0	0	57	0	0	57

PLOTS=GROV YR=76 VARIETY=TX TREE=8

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	251	243	0	0	0	8	0	0	0	0	0	0
BLOW	C	I	5	0	0	0	0	0	0	0	5	0	0	2
BLOW	C	M	2	0	0	0	0	0	0	0	0	0	0	2
BLOW	C	Y	0	0	0	0	0	0	0	0	0	0	0	0
BLOW	N	M	17	1	2	0	1	0	0	0	4	0	2	13
BLOW	P	M	4	0	0	0	0	0	0	0	3	0	1	2
CONV	C	I	85	0	0	0	3	0	0	0	9	1	0	0
CONV	C	M	71	0	0	26	33	3	0	19	9	0	0	3
CONV	C	Y	54	0	0	0	0	0	0	0	54	0	0	0
CONV	N	I	36	19	0	0	76	0	0	0	38	0	133	114
CONV	N	M	115	4	0	2	7	0	0	11	0	0	8	80
CONV	P	I	7	0	0	0	0	0	0	1	6	0	0	0
CONV	P	M	32	5	0	3	7	0	0	5	15	0	1	1
CONV	P	Y	5	0	0	0	0	0	0	1	4	0	0	0
SACT	N	M	7052	6832	0	0	0	220	0	0	0	0	0	0

PLOTS=GROV YR=76 VARIETY=TX TREE=9

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	300	268	0	0	0	0	0	0	0	0	0	28
BLOW	C	I	79	0	0	0	0	0	0	4	75	0	0	13
BLOW	C	M	271	0	5	3	0	0	0	19	244	0	0	16
BLOW	C	Y	21	0	0	0	0	0	0	0	21	0	0	0
BLOW	N	I	2	0	0	0	0	0	0	0	2	0	0	0
BLOW	N	M	165	95	3	0	0	3	0	11	13	0	8	41
BLOW	P	I	4	0	0	0	0	0	0	0	4	0	0	2
BLOW	P	M	109	1	3	1	2	1	0	6	97	0	0	26
CONV	C	I	59	0	0	0	0	0	0	0	59	0	0	12
CONV	C	M	224	16	67	29	27	11	0	56	49	0	0	0
CONV	C	Y	13	0	0	0	0	0	0	0	13	0	0	4
CONV	N	I	5	1	0	0	0	0	0	0	0	0	2	2
CONV	N	M	437	45	4	4	4	4	0	4	25	0	82	286
CONV	P	I	6	0	0	0	0	0	0	2	3	0	0	5
CONV	P	M	39	10	6	3	3	4	0	9	6	0	0	4
CONV	P	Y	2	0	0	0	0	0	0	0	2	0	0	1
SACT	N	M	8343	7465	0	0	0	0	0	0	0	0	0	790

PLOTS=GROV YR=76 VARIETY=TX TREE=10

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	105	103	0	0	0	0	0	1	0	0	0	2
BLOW	C	I	100	0	0	0	0	0	0	0	100	0	0	0
BLOW	C	M	250	0	0	63	0	0	0	125	63	0	0	125
BLOW	C	Y	75	0	0	0	0	0	0	50	25	25	0	0
BLOW	N	I	25	0	0	0	0	0	0	25	0	0	0	0
BLOW	N	M	600	600	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	75	0	25	0	0	0	0	0	50	0	0	24
BLOW	P	M	25	0	0	0	0	0	0	0	25	0	0	25
CONV	C	I	20	1	0	0	0	0	0	4	15	0	0	3
CONV	C	M	79	4	8	32	10	0	0	22	9	0	0	0
CONV	C	Y	24	0	0	0	0	0	0	0	24	0	0	3
CONV	N	I	15	13	0	0	0	0	0	2	0	0	0	0
CONV	N	M	441	13	0	0	0	0	0	0	4	0	0	428
CONV	P	M	11	3	2	0	2	0	0	2	4	0	1	1
SACT	N	M	7820	7664	0	0	0	0	0	78	0	0	0	156

APPENDIX C

NUTS PROCESSED BY A CLEANING MACHINE WITH VARIOUS TYPES OF DAMAGE DATA FOR 1978 "TEXAS 60" CULTIVAR

1978 "TEXAS 60" APPENDIX C CODE

YR = Year
TX = Texas 60 Cultivar
SOURCES = Separation of nuts on the cleaning machine
BELT = Sample selected from the sack
BLOW = Nuts subjected to air flow
CONV = Hand removal of rejected nuts
COVER = Amount of shuck
  N = No shuck
  P = Partial shuck
  C = Complete shuck
MATURITY = Nut size
  M = Large
  I = Medium
  Y = Small
COLLECT = Total nuts
GOOD PROJ = Good nuts
WVLC PROJ = Nuts punctured by the pecan weevil
HOLS PROJ = Larva exit holes
GRUB PROJ = Presence of larva
STNK PROJ = Nuts punctured by the stinkbug
SHKW PROJ = Nuts damaged by shuckworm
SHRI PROJ = Nuts with shrivelled kernels
BLAK PROJ = Nuts with black kernels
DISE PROJ = Diseased nuts
ANIMR POJ = Animal damage
MECHR POJ = Mechanical damage

PLOTS=GROV YR=78 VARIETY=TX TREE=1

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLOPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	278	272	3	0	0	3	0	0	0	0	0	0
BLOW	C	I	188	7	0	0	18	0	0	7	135	25	4	28
BLOW	C	M	124	7	1	1	1	1	5	39	59	10	0	6
BLOW	C	Y	35	0	0	0	0	0	0	9	22	4	0	2
BLOW	N	I	23	7	0	0	0	0	0	14	0	0	1	4
BLOW	N	M	417	268	6	6	0	6	6	36	6	0	0	89
BLOW	P	I	14	0	0	0	0	0	0	3	9	2	3	1
BLOW	P	M	28	2	0	0	0	1	0	5	13	5	1	5
BLOW	P	Y	2	0	0	0	0	0	0	0	2	0	0	0
SACT	N	M	24531	24040	245	0	0	245	0	0	0	0	0	0

PLOTS=GROV YR=79 VARIETY=TX TREE=2

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLOPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	164	149	10	0	0	0	0	0	0	0	0	5
BLOW	C	I	168	2	2	0	0	0	0	51	105	10	3	10
BLOW	C	M	116	7	0	0	0	0	0	26	83	0	1	2
BLOW	C	Y	42	2	0	0	0	0	0	8	32	1	0	0
BLOW	N	I	39	24	0	0	0	2	0	8	1	0	0	7
BLOW	N	M	230	163	7	0	0	0	0	2	5	0	12	44
BLOW	N	Y	3	3	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	14	1	0	0	0	0	0	1	13	0	0	1
BLOW	P	M	48	6	0	1	1	0	1	15	29	0	0	6
BLOW	P	Y	3	0	0	0	0	0	0	0	3	0	0	0
CONV	C	I	253	15	8	0	0	0	5	61	170	3	3	10
CONV	C	M	946	255	38	9	0	19	38	246	359	9	9	0
CONV	C	Y	19	0	0	0	0	0	0	5	14	0	0	1
CONV	N	I	328	272	0	0	0	0	0	7	13	3	7	30
CONV	N	M	1269	470	25	25	0	0	13	0	0	0	51	711
CONV	P	I	29	9	2	2	0	0	0	3	14	0	1	3
CONV	P	M	211	92	13	0	0	2	19	44	46	2	8	6
CONV	P	Y	0	0	0	0	0	0	0	0	0	0	0	0
SACT	N	M	14515	13195	880	0	0	0	0	0	0	0	0	440

PLOTS=GROV YR=78 VARIETY=TX TREE=3

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	160	157	2	0	0	0	0	2	0	0	0	0
BLOW	C	I	76	2	0	0	0	0	1	29	45	0	1	4
BLOW	C	M	143	1	0	1	0	0	1	26	113	1	3	10
BLOW	C	Y	18	0	0	0	0	0	0	11	7	0	0	0
BLOW	N	I	18	2	0	0	0	0	0	14	0	0	1	4
BLOW	N	M	393	288	0	0	0	8	0	23	4	0	0	70
BLOW	N	Y	4	0	0	0	0	0	0	2	2	0	0	2
BLOW	P	I	3	0	0	0	0	0	0	2	1	0	0	0
BLOW	P	M	35	0	0	0	4	0	0	18	14	0	1	3
BLOW	P	Y	0	0	0	0	0	0	0	0	0	0	0	0
CONV	C	I	127	4	3	0	0	0	1	58	58	1	3	1
CONV	C	M	412	58	0	0	0	0	0	82	255	12	0	8
CONV	C	Y	11	1	0	0	0	0	0	4	7	0	0	1
CONV	N	I	57	35	1	0	0	0	0	14	5	0	2	5
CONV	N	M	206	80	0	0	0	0	0	18	2	0	2	108
CONV	N	Y	4	4	0	0	0	0	0	0	0	0	0	0
CONV	P	I	4	0	0	0	0	0	0	2	2	0	0	0
CONV	P	M	113	29	0	0	0	0	6	31	43	2	3	12
SACT	N	M	14940	14641	149	0	0	0	0	149	0	0	0	0

PLOTS=GROV YR=78 VARIETY=TX TREE=4

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	362	340	7	0	0	0	0	4	0	0	0	11
BLOW	C	I	154	0	0	0	0	0	2	51	102	2	5	10
BLOW	C	M	116	8	0	0	0	0	1	27	81	0	3	2
BLOW	C	Y	30	0	0	0	0	0	0	15	15	0	0	2
BLOW	N	I	4	1	0	0	0	0	0	3	0	0	0	0
BLOW	N	M	334	292	0	0	0	0	0	0	0	0	0	42
BLOW	P	I	8	0	0	0	0	0	0	3	5	0	0	0
BLOW	P	M	48	3	0	1	0	0	2	11	33	0	0	9
BLOW	P	Y	2	0	0	0	0	0	0	1	1	0	0	0
CONV	C	I	108	4	0	0	0	0	0	55	48	1	0	4
CONV	C	M	696	174	0	0	0	0	27	174	335	0	0	13
CONV	C	Y	2	0	0	0	0	0	0	0	2	0	0	0
CONV	N	I	60	37	0	0	0	0	0	11	4	0	2	9
CONV	N	M	284	109	4	0	0	4	0	25	27	0	4	116
CONV	N	Y	2	0	0	0	0	0	0	0	2	0	0	0
CONV	P	I	14	3	0	0	0	0	0	4	7	0	0	5
CONV	P	M	206	68	0	0	2	0	8	58	68	4	2	21
CONV	P	Y	1	0	0	0	0	0	0	0	1	0	0	0
SACT	N	M	16637	15639	333	0	0	0	0	166	0	0	0	499

PLOTS=GROV YR=78 VARIETY=TX TREE=5

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	256	236	3	0	0	3	0	15	0	0	0	0
BLOW	C	I	230	18	0	0	0	0	2	93	116	2	0	0
BLOW	C	M	17	5	0	0	0	0	0	6	4	2	0	1
BLOW	C	Y	33	0	0	0	0	0	0	7	26	0	0	1
BLOW	N	I	215	125	17	0	0	2	0	9	2	4	4	62
BLOW	N	M	9	2	0	0	0	1	0	0	0	1	0	6
BLOW	N	Y	6	1	2	0	0	0	0	1	0	0	0	2
BLOW	P	I	40	4	1	0	0	1	0	11	6	17	3	1
BLOW	P	M	6	0	1	0	0	0	0	1	0	4	0	0
BLOW	P	Y	10	0	1	0	0	0	0	3	3	3	1	3
CONV	C	I	205	33	8	0	0	2	0	68	68	29	0	0
CONV	C	M	96	27	0	0	0	4	0	27	12	27	0	0
CONV	C	Y	27	1	0	0	0	0	0	7	9	10	0	0
CONV	N	I	323	74	6	0	0	0	0	3	13	0	6	233
CONV	N	M	28	10	2	0	0	1	0	5	2	4	2	3
CONV	P	I	85	40	2	0	0	1	0	16	40	1	1	5
CONV	P	M	21	11	1	0	0	0	0	5	5	0	0	0
CONV	P	Y	4	1	0	0	0	0	0	2	1	0	0	0
SACT	N	M	1783	1640	18	0	0	18	0	107	0	0	0	0

PLOTS=GROV YR=78 VARIETY=TX TREE=6

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	209	205	0	0	0	0	0	4	0	0	0	0
BLOW	C	I	156	2	0	0	0	0	0	29	118	6	2	6
BLOW	C	M	122	11	1	0	0	0	0	31	71	7	0	1
BLOW	C	Y	60	0	0	0	0	0	0	21	38	1	5	0
BLOW	N	I	18	2	1	0	0	0	0	13	1	0	0	2
BLOW	N	M	698	524	0	14	0	7	0	42	0	0	7	105
BLOW	P	I	24	1	0	0	0	0	0	5	18	3	3	12
BLOW	P	M	73	5	0	2	0	0	4	22	37	4	3	18
CONV	C	I	65	5	0	0	0	0	1	20	34	6	0	3
CONV	C	M	247	59	2	5	0	0	22	86	64	12	0	5
CONV	N	I	26	11	0	0	0	0	0	10	2	2	0	5
CONV	N	M	4020	2010	80	40	0	40	0	40	0	40	40	1989
CONV	N	Y	3	2	0	0	0	0	0	0	0	0	0	1
CONV	P	I	15	2	0	0	0	0	0	5	8	0	0	1
CONV	P	M	256	81	8	5	0	0	10	81	53	8	28	3
CONV	P	Y	1	0	0	0	0	0	0	0	1	0	0	0
SACT	N	M	16213	15889	0	0	0	0	0	324	0	0	0	0

PLOTS=GROV YR=78 VARIETY=TX TREE=7

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLGPROJ	HOLSPROJ	GRUBPROJ	STAKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	116	101	1	0	0	0	0	1	0	0	0	14
BLOW	C	I	15	2	0	1	0	0	1	4	6	1	1	0
BLOW	C	M	19	0	0	0	0	0	0	8	9	2	0	0
BLOW	C	Y	11	0	0	0	0	0	0	0	11	0	0	0
BLOW	N	I	3	2	0	0	0	0	0	0	0	0	1	0
BLOW	N	M	41	29	1	0	0	0	0	2	0	0	0	11
BLOW	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	7	0	0	0	0	0	0	0	7	0	4	0
BLOW	P	M	9	1	0	0	0	0	1	3	3	1	1	2
BLOW	P	Y	8	0	0	0	0	0	0	0	8	1	2	1
CONV	C	I	321	33	7	0	0	0	0	69	205	7	0	3
CONV	C	M	387	67	0	8	4	0	8	150	150	4	4	4
CONV	C	Y	36	0	0	0	0	0	0	15	21	0	0	1
CONV	N	I	12	0	2	1	0	1	0	7	1	0	0	3
CONV	N	M	795	184	8	50	0	0	0	17	8	0	33	536
CONV	N	Y	2	0	0	0	0	0	0	0	1	0	1	0
CONV	P	I	16	1	0	0	0	0	0	3	9	1	2	10
CONV	P	M	287	60	15	3	0	0	9	96	93	3	6	24
CONV	P	Y	4	0	0	0	0	0	0	0	4	0	0	0
SACT	N	M	15958	13883	160	0	0	0	0	160	0	0	0	1915

PLOTS=GROV YR=78 VARIETY=TX TREE=8

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLGPROJ	HOLSPROJ	GRUBPROJ	STAKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	137	133	0	0	0	0	0	1	0	0	0	3
BLOW	C	I	24	2	0	0	0	0	0	5	23	0	0	0
BLOW	C	Y	8	0	0	0	0	0	0	1	7	0	0	0
BLOW	N	I	1	1	0	0	0	0	0	0	0	0	0	0
BLOW	N	M	106	72	2	0	0	0	0	2	3	0	2	27
BLOW	P	M	16	1	0	0	0	0	7	3	5	3	0	1
CONV	C	I	41	2	0	0	0	0	0	12	25	2	0	1
CONV	C	M	298	54	3	3	0	6	9	113	63	39	0	24
CONV	C	Y	6	0	0	0	0	0	0	1	4	1	0	0
CONV	N	I	8	6	0	0	0	0	0	2	0	0	0	0
CONV	N	M	173	17	3	0	0	0	0	2	2	0	0	149
CONV	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
CONV	P	I	5	0	0	0	0	0	0	4	1	0	0	2
CONV	P	M	59	19	0	0	0	0	0	28	11	1	1	0
SACT	N	M	5518	5354	0	0	0	0	0	55	0	0	0	109

PLOTS=GROV YR=78 VARIETY=TX TREE=9

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLGPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	103	101	0	0	0	0	0	0	0	0	0	2
BLOW	C	I	31	0	0	0	0	0	0	8	21	2	0	0
BLOW	C	M	52	9	2	0	0	2	6	26	15	2	0	0
BLOW	C	Y	6	0	0	0	0	0	0	4	2	0	0	1
BLOW	N	I	4	2	0	0	0	0	0	1	1	0	0	0
BLOW	N	M	99	83	0	2	0	0	0	0	2	0	0	12
BLOW	P	I	2	0	0	0	0	0	0	1	1	0	0	1
BLOW	P	M	7	1	1	0	0	0	0	3	2	0	0	0
CONV	C	I	33	2	0	0	0	0	0	10	21	0	0	0
CONV	C	M	217	72	2	41	0	0	7	72	24	2	2	7
CONV	C	Y	6	0	0	0	0	0	0	2	4	0	0	0
CONV	N	I	8	7	0	0	0	0	0	1	0	0	0	0
CONV	N	M	444	44	4	4	0	0	0	0	0	0	0	391
CONV	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
CONV	P	I	1	1	0	0	0	0	0	0	0	0	0	0
CONV	P	M	43	12	4	3	0	1	3	14	6	3	1	2
SACT	N	M	6790	6654	0	0	0	0	0	0	0	0	0	136

PLOTS=GROV YR=78 VARIETY=TX TREE=10

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLGPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	143	137	0	0	0	0	0	1	0	0	0	3
BLOW	C	I	23	0	0	0	0	0	0	8	15	0	0	0
BLOW	C	M	25	1	0	0	0	0	1	8	15	0	0	0
BLOW	C	Y	11	0	0	0	0	0	0	1	10	0	0	.
BLOW	N	M	350	229	7	0	0	0	0	13	13	0	37	54
BLOW	P	I	1	0	0	0	0	0	0	0	1	0	0	1
BLOW	P	M	5	0	0	0	0	0	0	1	4	0	1	3
CONV	C	I	51	6	0	0	0	0	0	9	24	11	2	4
CONV	C	M	256	49	13	0	0	0	13	102	46	33	0	8
CONV	C	Y	4	0	0	0	0	0	0	1	3	0	0	0
CONV	N	I	11	7	0	0	0	0	0	3	0	1	0	0
CONV	N	M	1039	281	31	0	0	0	0	0	0	0	0	738
CONV	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
CONV	P	I	5	1	0	0	0	0	0	4	0	0	0	0
CONV	P	M	53	17	1	1	0	1	7	18	5	3	0	7
SACT	N	M	11459	11001	0	0	0	0	0	115	0	0	0	229

APPENDIX D

NUTS PROCESSED BY A CLEANING MACHINE

WITH VARIOUS TYPES OF DAMAGE

DATA FOR 1978 "STUART"

CULTIVAR

1978 "STUART" APPENDIX D CODE

YR = Year
ST = Stuart Cultivar
SOURCES = Separation of nuts on the cleaning machine
BELT = Sample selected from the sack
BLOW = Nuts subjected to air flow
CONV = Hand removal of rejected nuts
COVER = Amount of shuck
  N = No shuck
  P = Partial shuck
  C = Complete shuck
MATURITY = Nut size
  M = Large
  I = Medium
  Y = Small
COLLECT = Total nuts
GOOD PROJ = Good nuts
WVLC PROJ = Nuts punctured by the pecan weevil
HOLS PROJ = Larva exit holes
GRUB PROJ = Presence of larva
STNK PROJ = Nuts punctured by the stinkbug
SHKW PROJ = Nuts damaged by shuckworm
SHRI PROJ = Nuts with shrivelled kernels
BLAK PROJ = Nuts with black kernels
DISE PROJ = Diseased nuts
ANIMR POJ = Animal damage
MECHR POJ = Mechanical damage

PLOTS=M&M YR=78 VARIETY=ST TREE=1

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	175	171	2	0	0	0	0	2	0	0	0	0
BLOW	C	I	25	0	0	0	0	0	0	7	17	1	0	4
BLOW	C	M	45	10	4	3	1	0	2	15	12	0	0	0
BLOW	C	Y	50	0	0	0	0	0	0	3	46	1	0	0
BLOW	N	M	82	73	0	1	0	1	0	0	3	1	0	3
BLOW	P	I	3	0	0	0	0	0	0	0	3	0	0	1
BLOW	P	M	14	3	0	0	0	0	1	8	3	0	0	0
CONV	C	I	103	4	0	1	0	0	1	35	63	0	1	8
CONV	C	M	663	107	13	201	0	0	20	208	121	7	0	13
CONV	C	Y	36	0	0	0	0	0	0	15	21	0	0	0
CONV	N	M	1601	550	0	16	0	16	0	32	97	0	0	905
CONV	P	I	6	1	1	0	0	0	0	4	1	0	0	1
CONV	P	M	181	84	7	9	0	2	5	46	20	4	0	18
CONV	P	Y	3	0	0	0	0	0	0	0	3	0	0	2
GGRA	C	M	14	6	3	0	0	0	3	2	1	1	0	0
GGRA	N	M	83	76	0	0	0	0	0	6	0	1	0	0
GGRA	P	M	5	3	0	0	0	0	2	0	0	0	0	0
SACT	N	M	8369	8198	85	0	0	0	0	85	0	0	0	0
TGRA	C	M	2	0	0	0	0	0	0	2	0	0	0	0
TGRA	N	M	96	93	0	0	0	0	0	3	0	0	0	0
TGRA	P	M	1	0	0	0	1	0	0	0	0	0	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=2

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	234	232	0	0	0	0	0	2	0	0	0	0
BLOW	C	I	11	0	0	0	0	0	0	2	8	1	0	2
BLOW	C	M	34	1	0	1	0	0	1	17	14	0	0	1
BLOW	C	Y	15	0	0	0	0	0	0	2	13	0	0	0
BLOW	N	M	74	65	0	0	0	0	0	0	0	0	1	8
BLOW	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	2	0	0	0	0	0	0	1	1	0	0	0
BLOW	P	M	12	2	0	0	0	0	0	4	6	0	0	2
CONV	C	I	135	11	1	0	1	0	1	46	76	1	0	13
CONV	C	M	496	50	5	94	0	5	45	248	89	5	0	5
CONV	C	Y	28	0	0	0	0	0	0	11	17	0	0	4
CONV	N	I	6	4	0	0	0	0	0	1	1	0	0	0
CONV	N	M	252	150	0	0	0	0	0	7	2	2	10	117
CONV	N	Y	2	0	0	0	0	0	0	0	2	0	0	0
CONV	P	I	9	1	0	0	0	0	0	4	4	0	0	1
CONV	P	M	257	98	3	8	0	0	8	84	59	0	3	8
GGRA	C	M	13	5	0	0	0	0	0	5	3	0	0	0
GGRA	N	I	1	1	0	0	0	0	0	0	0	0	0	0
GGRA	N	M	81	75	0	0	0	0	0	3	2	0	0	1
GGRA	P	M	5	4	0	0	0	0	0	1	0	0	0	0
SACT	N	M	10054	9954	0	0	0	0	0	100	0	0	0	0
TGRA	C	M	2	0	0	0	0	0	0	1	1	0	0	0
TGRA	N	M	97	94	0	0	0	0	0	2	1	0	0	0
TGRA	P	M	1	0	0	0	0	0	0	1	0	0	0	0

PLOTS=MSM YR=78 VARIETY=ST TREE=3

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLOPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	199	197	0	0	0	0	0	2	0	0	0	0
BLOW	C	I	49	9	0	0	0	0	0	19	27	3	0	2
BLOW	C	M	69	11	2	0	0	0	0	37	16	4	0	4
BLOW	C	Y	121	3	0	0	0	0	0	3	114	0	0	17
BLOW	N	M	61	55	0	1	0	0	0	4	0	0	0	1
BLOW	P	I	2	0	0	0	0	0	0	2	0	0	0	0
BLOW	P	M	12	2	0	0	0	0	2	7	2	1	0	3
BLOW	P	Y	3	0	0	0	0	0	0	0	3	0	0	0
CONV	C	I	112	2	0	1	0	0	1	50	47	6	2	4
CONV	C	M	873	148	26	35	0	0	17	489	157	9	0	9
CONV	C	Y	40	0	0	0	0	0	0	13	26	1	0	1
CONV	N	I	70	57	0	0	0	0	0	3	8	0	3	0
CONV	N	M	243	122	5	2	2	0	0	7	2	2	2	107
CONV	P	I	22	3	0	2	0	0	1	5	10	0	3	4
CONV	P	M	266	111	14	14	5	5	11	60	60	0	3	14
GGRA	C	M	22	3	0	0	0	0	5	15	2	0	0	0
GGRA	N	M	70	69	0	0	0	0	0	1	0	0	0	0
GGRA	P	M	8	5	0	0	0	0	1	2	0	0	0	0
SACT	N	M	9099	9005	0	0	0	0	0	94	0	0	0	0
TGRA	C	M	4	0	1	0	0	0	0	2	1	0	0	0
TGRA	N	I	0	0	0	0	0	0	0	0	0	0	0	0
TGRA	N	M	100	95	0	1	0	0	0	3	0	0	0	0

PLOTS=MSM YR=78 VARIETY=ST TREE=4

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLOPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	148	114	0	0	0	0	0	31	0	0	0	3
BLOW	C	I	61	0	0	0	0	0	0	9	50	2	0	10
BLOW	C	M	133	70	3	1	0	0	0	24	33	1	0	3
BLOW	C	Y	39	0	0	0	0	0	0	0	39	0	0	7
BLOW	N	I	5	2	0	1	0	0	0	1	1	0	0	0
BLOW	N	M	106	100	0	0	0	1	0	1	0	0	1	3
BLOW	N	Y	4	2	0	0	0	0	0	1	1	0	0	0
BLOW	P	I	4	2	0	0	0	0	0	0	2	0	0	0
BLOW	P	M	32	23	0	0	0	0	0	4	4	1	0	5
CONV	C	I	158	20	0	2	0	0	2	56	84	2	0	5
CONV	C	M	2225	1491	92	69	0	0	23	413	161	0	46	33
CONV	C	Y	42	1	0	0	0	0	0	6	32	1	1	2
CONV	N	I	160	131	2	3	0	0	0	8	10	2	0	13
CONV	N	M	1029	864	10	2	0	0	0	10	0	0	0	134
CONV	N	Y	7	7	0	0	0	0	0	0	0	0	0	0
CONV	P	I	9	2	0	0	0	0	0	1	5	1	0	2
CONV	P	M	698	517	0	0	0	7	14	77	70	7	0	21
GGRA	C	I	4	0	0	0	0	0	0	2	1	1	0	0
GGRA	C	M	55	10	0	0	0	0	7	32	6	2	0	0
GGRA	N	M	12	5	0	1	0	0	1	5	0	0	0	0
GGRA	P	I	1	0	0	0	0	0	0	0	1	0	0	0
GGRA	P	M	28	6	0	0	0	0	6	13	2	0	0	0
SACT	N	M	6291	4849	0	0	0	0	0	1311	0	0	0	131
TGRA	C	M	0	0	0	0	0	0	0	0	0	0	0	0
TGRA	N	M	95	94	0	0	0	1	0	0	0	0	0	0
TGRA	P	M	6	6	0	0	0	0	0	0	0	0	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=5

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	206	200	0	0	0	0	0	6	0	0	0	0
BLOW	C	M	53	8	1	4	0	0	2	20	17	1	1	3
BLOW	N	I	2	1	0	0	0	0	0	1	0	0	0	0
BLOW	N	M	140	121	1	3	0	0	6	1	1	0	0	6
BLOW	N	Y	1	0	0	0	0	0	0	0	0	0	0	1
BLOW	P	I	0	0	0	0	0	0	0	0	0	0	0	0
BLOW	P	M	14	2	0	0	0	2	6	3	2	0	1	1
CONV	C	I	141	20	0	0	0	0	3	39	80	0	1	6
CONV	C	M	730	277	44	110	29	0	22	277	102	58	7	7
CONV	C	Y	45	0	0	0	0	0	0	30	15	0	0	10
CONV	N	I	137	110	0	1	0	1	0	7	6	3	0	11
CONV	N	M	476	105	24	0	0	0	10	0	0	0	0	324
CONV	P	I	11	2	0	0	0	0	0	5	4	0	0	1
CONV	P	M	185	79	9	31	0	2	14	34	18	7	0	23
GGRA	C	M	22	4	1	0	0	0	3	13	4	0	0	1
GGRA	N	M	67	62	0	0	0	0	1	5	0	0	0	0
GGRA	P	M	10	3	0	1	0	0	4	4	0	0	0	0
SACT	N	M	10616	10298	0	0	0	0	0	318	0	0	0	0
TGRA	N	I	0	0	0	0	0	0	0	0	0	0	0	0
TGRA	N	M	95	93	0	0	0	0	0	1	0	1	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=6

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	163	147	2	0	0	0	0	15	0	0	0	0
BLOW	C	I	36	0	0	0	0	0	0	21	15	0	0	12
BLOW	C	M	86	38	1	0	0	1	0	22	23	1	1	2
BLOW	C	Y	66	0	0	0	0	0	0	22	44	0	1	23
BLOW	N	I	3	2	0	0	0	0	0	2	0	0	2	0
BLOW	N	M	124	114	0	0	0	0	0	4	1	0	0	5
BLOW	N	Y	1	0	0	0	0	0	0	1	0	0	1	0
BLOW	P	I	4	1	0	0	0	0	0	0	3	0	0	1
BLOW	P	M	47	31	1	2	0	0	5	3	5	0	1	3
CONV	C	I	105	9	1	0	0	1	2	32	53	0	0	3
CONV	C	M	1858	743	37	242	0	0	74	557	204	0	0	37
CONV	C	Y	66	0	0	0	0	0	0	44	22	0	0	13
CONV	N	I	66	42	0	0	0	0	0	0	6	0	2	18
CONV	N	M	760	517	0	0	0	0	0	15	0	0	0	228
CONV	P	I	6	1	1	0	0	0	0	0	4	0	0	0
CONV	P	M	533	437	11	11	0	0	21	43	21	0	0	21
GGRA	C	I	5	0	0	0	0	0	0	2	3	0	0	0
GGRA	C	M	77	21	1	0	0	0	1	41	12	2	0	0
GGRA	N	I	0	0	0	0	0	0	0	0	0	0	0	0
GGRA	N	M	12	8	0	0	0	0	0	4	0	0	0	0
GGRA	P	M	5	1	0	0	0	0	0	4	0	0	0	0
SACT	N	M	6347	5712	63	0	0	0	0	571	0	0	0	0
TGRA	N	M	40	34	2	0	0	3	0	1	0	0	0	0
TGRA	P	M	1	0	0	0	0	1	0	0	0	0	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=7

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	I	1	0	0	0	0	0	0	1	0	0	0	0
BELT	N	M	245	240	0	0	0	0	0	5	0	0	0	0
BLOW	C	I	27	0	0	0	0	0	0	3	23	1	1	4
BLOW	C	M	13	3	0	3	0	0	0	2	4	1	0	0
BLOW	C	Y	13	0	0	0	0	0	0	0	13	0	0	2
BLOW	N	I	3	1	0	0	0	0	0	2	0	0	0	0
BLOW	N	M	40	32	0	2	0	0	1	1	0	0	1	3
BLOW	N	Y	2	0	0	0	0	0	0	0	1	0	0	1
BLOW	P	I	1	0	0	0	0	0	0	1	0	0	0	0
CONV	C	I	79	7	1	1	0	0	0	25	45	2	1	3
CONV	C	M	310	31	6	93	3	0	9	115	62	3	0	0
CONV	C	Y	16	0	0	0	0	0	0	1	15	0	0	5
CONV	N	I	55	47	0	2	0	0	0	2	2	0	0	6
CONV	N	M	146	27	4	12	0	0	0	0	1	0	0	101
CONV	N	Y	32	24	1	0	0	0	0	0	4	0	0	5
CONV	P	I	4	0	0	0	0	0	0	1	3	0	0	0
CONV	P	M	47	13	0	16	0	0	2	10	6	0	1	5
SACT	N	I	0	0	0	0	0	0	0	0	0	0	0	0
SACT	N	M	3605	3532	0	0	0	0	0	73	0	0	0	0
TGRA	C	M	0	0	0	0	0	0	0	0	0	0	0	0
TGRA	N	M	96	94	2	0	0	0	0	0	0	0	0	0
TGRA	P	M	2	1	0	0	0	0	1	0	0	0	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=8

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	257	254	3	0	0	0	0	0	0	0	0	0
BLOW	C	I	27	0	0	0	0	0	0	9	18	0	0	5
BLOW	C	M	47	2	4	5	0	0	2	24	12	0	0	0
BLOW	C	Y	34	0	0	0	0	0	8	0	26	0	1	11
BLOW	N	M	89	78	0	0	0	1	0	1	1	0	0	8
BLOW	P	M	14	2	1	1	0	0	0	1	7	0	0	4
BLOW	P	Y	1	0	0	0	0	0	0	0	1	0	0	1
CONV	C	I	105	2	0	0	0	0	0	23	82	2	1	7
CONV	C	M	1157	236	57	137	11	11	23	515	149	0	11	0
CONV	C	Y	26	0	0	1	0	0	0	5	18	2	1	2
CONV	N	I	5	4	0	0	0	0	0	2	0	2	1	1
CONV	N	M	627	19	0	25	0	0	19	13	0	0	0	554
CONV	N	Y	1	0	0	0	0	0	0	0	0	1	0	0
CONV	P	I	4	1	0	0	0	0	0	1	2	0	0	1
CONV	P	M	180	85	7	13	0	0	9	38	23	7	2	9
GGRA	C	I	1	0	0	0	0	0	0	1	0	0	0	0
GGRA	C	M	35	12	0	0	0	0	0	12	9	1	0	1
GGRA	N	M	58	53	0	0	0	0	0	4	1	0	0	0
GGRA	P	M	6	3	0	0	0	0	0	2	0	0	0	1
SACT	N	M	14154	14012	142	0	0	0	0	0	0	0	0	0
TGRA	C	I	1	0	0	0	0	0	0	1	0	0	0	0
TGRA	N	M	97	95	1	0	0	0	0	1	0	0	0	0
TGRA	P	M	2	1	0	0	0	0	1	0	0	0	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=11

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRJBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	I	2	0	0	0	0	0	0	2	0	0	0	0
BELT	N	M	178	173	2	0	0	0	0	4	0	0	0	0
BLOW	C	I	13	0	0	0	0	0	0	5	10	0	0	5
BLOW	C	M	29	0	0	4	0	0	2	9	16	0	0	4
BLOW	C	Y	29	0	0	0	0	0	0	2	27	0	0	6
BLOW	N	I	3	0	0	0	0	0	0	1	1	0	1	1
BLOW	N	M	3	3	0	0	0	0	0	0	0	0	0	0
BLOW	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	1	0	0	0	0	0	0	0	1	0	0	0
BLOW	P	M	9	1	0	3	0	0	1	4	1	0	0	0
CONV	C	I	44	4	0	0	0	0	0	18	22	0	0	6
CONV	C	M	280	21	3	21	0	3	12	183	41	9	0	3
CONV	C	Y	12	0	0	1	0	0	0	0	11	0	0	0
CONV	N	I	12	5	0	0	0	0	0	1	6	0	0	4
CONV	N	M	23	4	1	2	0	0	0	1	0	0	0	15
CONV	N	Y	14	9	0	0	0	0	0	0	5	0	0	3
CONV	P	I	5	1	0	0	0	0	0	2	1	1	0	0
CONV	P	M	65	12	2	5	0	1	7	36	7	0	0	5
GGRA	C	M	22	6	1	0	0	0	7	6	4	1	0	1
GGRA	N	I	5	5	0	0	0	0	0	0	0	0	0	0
GGRA	N	M	71	66	1	0	0	0	0	1	1	1	1	0
GGRA	P	I	1	0	0	0	0	0	0	1	0	0	0	0
GGRA	P	M	3	2	0	0	0	0	1	0	0	0	0	0
SACT	N	I	0	0	0	0	0	0	0	0	0	0	0	0
SACT	N	M	843	817	9	0	0	0	0	17	0	0	0	0
TGRA	C	M	7	4	0	0	0	0	0	3	0	0	0	0
TGRA	N	M	99	98	1	0	0	0	0	0	0	0	0	0
TGRA	P	M	3	0	0	0	0	0	0	3	0	0	0	0

PLOTS=M&M YR=78 VARIETY=ST TREE=12

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRJBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	132	131	0	0	0	0	0	0	0	0	0	1
BLOW	C	I	21	0	0	0	0	0	0	12	9	0	0	5
BLOW	C	M	29	1	2	1	0	0	0	14	11	0	0	3
BLOW	C	Y	36	3	0	0	0	0	0	20	14	0	0	10
BLOW	N	I	2	0	0	0	0	0	0	1	0	0	1	0
BLOW	N	M	43	30	0	0	0	1	0	1	0	0	2	9
BLOW	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	2	0	0	0	0	0	0	0	2	0	0	2
BLOW	P	M	4	1	0	1	0	0	0	0	2	0	1	0
CONV	C	I	81	4	0	1	0	0	0	34	38	3	3	1
CONV	C	M	100	23	0	7	0	0	1	48	20	2	1	1
CONV	C	Y	20	1	0	0	0	0	0	2	15	1	0	2
CONV	N	I	145	122	0	1	0	0	0	6	6	0	9	7
CONV	N	M	208	32	0	4	0	0	6	4	2	0	0	160
CONV	N	Y	3	1	0	0	0	0	0	0	0	0	0	2
CONV	P	M	102	26	1	7	0	1	5	18	41	2	5	3
GGRA	C	M	36	14	0	0	0	0	4	7	10	0	0	0
GGRA	N	I	2	2	0	0	0	0	0	0	0	0	0	0
GGRA	N	M	59	56	1	0	0	0	0	2	0	0	0	0
GGRA	P	M	3	3	0	0	0	0	0	0	0	0	0	0
SACT	N	M	6572	6506	0	0	0	0	0	0	0	0	0	66
TGRA	C	M	6	2	0	0	0	0	0	4	0	0	0	0
TGRA	N	I	1	.	0	.	0	0	0	0	0	.	.	.
TGRA	N	M	92	92	0	0	0	0	0	0	0	0	0	0
TGRA	P	M	1	.	0	.	0	0	0	0	0	.	.	.

APPENDIX E

NUTS PROCESSED BY A CLEANING MACHINE

WITH VARIOUS TYPES OF DAMAGE

DATA FOR 1979 "STUART"

CULTIVAR

1979 "STUART" APPENDIX E CODE

YR = Year
ST = Stuart Cultivar
SOURCES = Separation of nuts on the cleaning machine
BELT = Sample selected from the sack
BLOW = Nuts subjected to air flow
CONV = Hand removal of rejected nuts
COVER = Amount of shuck
  N = No shuck
  P = Partial shuck
  C = Complete shuck
MATURITY = Nut size
  M = Large
  I = Medium
  Y = Small
COLLECT = Total nuts
GOOD PROJ = Good nuts
WVLC PROJ = Nuts punctured by the pecan weevil
HOLS PROJ = Larva exit holes
GRUB PROJ = Presence of larva
STNK PROJ = Nuts punctured by the stinkbug
SHKW PROJ = Nuts damaged by shuckworm
SHRI PROJ = Nuts with shrivelled kernels
BLAK PROJ = Nuts with black kernels
DISE PROJ = Diseased nuts
ANIMR POJ = Animal damage
MECHR POJ = Mechanical damage

PLOTS=M&M YR=79 VARIETY=ST TREE=1

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLOPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	204	182	2	0	0	0	0	8	8	0	0	4
BLOW	C	I	143	4	1	0	0	0	0	41	77	14	7	17
BLOW	C	M	150	17	2	2	0	0	0	65	59	6	3	12
BLOW	C	Y	8	0	0	0	0	0	0	0	8	0	0	0
BLOW	N	M	309	6	0	0	0	0	0	15	9	0	3	281
BLOW	P	I	39	6	0	0	0	0	0	14	7	8	2	11
BLOW	P	M	57	0	0	3	0	0	0	13	22	2	2	29
CONV	C	I	197	30	2	0	0	0	2	162	0	0	0	0
CONV	C	M	762	320	183	182	23	0	46	168	30	23	0	0
CONV	N	I	4	2	0	0	0	0	0	0	0	1	1	0
CONV	N	M	345	72	17	14	17	0	0	0	24	0	0	335
CONV	P	I	5	3	0	0	0	0	0	2	0	0	0	0
CONV	P	M	508	198	66	66	0	0	0	112	10	30	0	5
SACT	N	M	11400	10146	114	0	0	0	0	456	456	0	0	228
TGRA	N	M	100	89	0	0	0	0	0	10	1	0	0	0

PLOTS=M&M YR=79 VARIETY=ST TREE=2

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLOPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	240	192	0	0	0	0	2	0	0	0	0	46
BLOW	C	I	0	0	0	0	0	0	0	0	0	0	0	0
BLOW	C	M	39	0	0	0	0	0	0	14	21	4	0	0
BLOW	C	Y	36	0	0	0	0	0	1	8	19	8	0	1
BLOW	N	M	19	1	0	0	0	0	0	8	6	2	0	15
BLOW	N	Y	1	1	0	0	0	0	0	0	0	0	0	0
BLOW	P	I	6	1	0	0	0	0	2	1	3	1	0	4
BLOW	P	M	24	0	0	1	0	0	0	5	10	3	0	9
BLOW	P	Y	2	0	0	0	0	0	0	0	2	0	0	1
CONV	C	I	7	0	0	0	0	0	0	6	1	0	0	0
CONV	C	M	300	87	78	108	9	0	18	81	54	3	0	0
CONV	N	I	14	8	0	0	0	0	0	4	1	1	0	0
CONV	N	M	207	31	4	4	0	0	0	2	0	4	0	172
CONV	N	Y	2	2	0	0	0	0	0	0	0	0	0	0
CONV	P	I	6	0	0	0	0	0	0	4	2	0	0	0
CONV	P	M	125	68	3	10	5	0	5	34	14	3	0	4
SACT	N	M	4432	3546	0	0	0	0	44	0	0	0	0	842
TGRA	N	M	100	98	0	0	0	0	0	2	0	0	0	0

PLOTS=M&M YR=79 VARIETY=ST TREE=3

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	302	293	3	0	0	0	0	0	0	0	0	5
BLOW	C	I	119	8	0	0	0	0	0	43	58	10	0	2
BLOW	C	M	105	3	0	0	0	0	0	57	21	23	0	5
BLOW	C	Y	96	0	0	0	0	0	0	26	52	10	0	9
BLOW	N	I	17	4	0	0	0	0	0	6	3	0	2	9
BLOW	N	M	154	102	1	0	0	0	0	12	5	0	10	50
BLOW	N	Y	10	1	0	0	0	0	0	4	2	0	0	4
BLOW	P	I	24	8	0	0	0	0	0	7	7	2	0	1
BLOW	P	M	35	0	0	0	0	0	0	6	19	9	0	16
BLOW	P	Y	0	0	0	0	0	0	0	0	0	0	0	0
CONV	C	I	72	21	1	0	0	1	0	41	7	0	0	0
CONV	C	M	1417	921	85	85	0	0	43	269	57	14	14	0
CONV	C	Y	3	0	0	0	0	0	0	0	3	0	0	1
CONV	N	I	143	106	6	1	0	0	0	6	1	11	0	6
CONV	N	M	310	37	6	3	0	0	0	0	12	0	3	245
CONV	N	Y	2	1	1	0	0	0	0	0	0	1	0	0
CONV	P	I	5	1	0	0	0	0	0	2	2	0	0	0
CONV	P	M	209	144	10	15	0	0	0	19	21	0	0	6
SACT	N	M	9804	9510	98	0	0	0	0	0	0	0	0	196
TGRA	N	M	101	94	0	0	0	0	0	5	2	0	0	0

PLOTS=M&M YR=79 VARIETY=ST TREE=4

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STNKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	300	288	0	0	0	0	0	0	0	0	0	12
BLOW	C	I	70	0	0	0	0	0	0	0	49	1	11	7
BLOW	C	M	36	0	0	0	0	0	0	3	32	0	2	2
BLOW	C	Y	22	4	0	1	0	0	0	0	16	1	3	3
BLOW	N	I	7	3	0	0	0	0	0	1	1	0	0	2
BLOW	N	M	90	15	0	0	0	0	0	4	4	3	0	119
BLOW	N	Y	2	0	0	0	0	0	0	0	0	0	1	0
BLOW	P	I	2	0	0	0	0	0	0	0	2	0	0	0
BLOW	P	M	16	1	0	0	0	0	0	2	4	0	5	5
CONV	C	I	3	0	0	0	0	0	0	0	3	0	0	0
CONV	C	M	376	244	0	0	0	0	0	71	41	4	0	19
CONV	N	I	5	4	0	0	0	0	0	0	0	0	1	0
CONV	P	M	148	84	6	0	0	0	0	25	25	0	0	7
SACT	N	M	6384	6129	0	0	0	0	0	0	0	0	0	255
TGRA	N	M	104	103	0	0	0	0	0	1	0	0	0	0

PLOTS=M&M YR=79 VARIETY=ST TREE=5

SOURCES	COVER	MATURITY	COLLECT	GOODPROJ	WVLCPROJ	HOLSPROJ	GRUBPROJ	STAKPROJ	SHKWPROJ	SHRIPROJ	BLAKPROJ	DISEPROJ	ANIMPROJ	MECHPROJ
BELT	N	M	209	201	2	0	0	0	0	4	0	0	0	2
BLOW	C	I	75	10	0	2	0	0	3	4	55	1	0	30
BLOW	C	M	284	43	0	11	0	0	11	31	162	6	0	40
BLOW	C	Y	4	0	0	0	0	0	0	0	4	0	0	0
BLOW	N	I	6	1	0	0	0	0	0	2	3	0	0	1
BLOW	N	M	38	1	0	0	0	0	0	2	2	0	1	32
BLOW	P	I	1	0	0	0	0	0	0	0	1	0	0	0
BLOW	P	M	20	1	1	3	0	0	0	3	14	0	1	1
CONV	C	M	586	281	12	35	0	0	12	152	82	0	0	0
CONV	C	Y	1	0	0	0	0	0	0	0	1	0	0	0
CONV	N	I	11	6	0	1	2	0	0	0	1	0	0	1
CONV	N	M	183	0	0	11	0	0	0	110	0	0	0	165
CONV	P	I	4	0	0	0	0	0	0	4	0	0	0	0
CONV	P	M	70	42	0	0	0	0	0	20	4	0	0	4
SACT	N	M	7524	7223	75	0	0	0	0	150	0	0	0	75
TGRA	N	M	107	101	1	0	0	0	0	3	1	0	0	0

VITA

Steven R. Jiracek

Candidate for the Degree of

Master of Science

Thesis: SOURCES AND MAGNITUDE OF PECAN NUT DAMAGE IN A COMMERCIALLY MANAGED PECAN ORCHARD

Major Field: Entomology

Biographical:

Personal Data: Born in Rockville Center, Long Island, New York, April 23, 1956, the son of Art and Audrey Jiracek.

Education: Graduated from Putnam City West, Oklahoma City, Oklahoma, May, 1974; received a Bachelor of Science in Agriculture degree from Oklahoma State University, Stillwater, Oklahoma, December, 1978; completed the requirements for a Master of Science Degree at Oklahoma State University, Stillwater, Oklahoma, December 1980.

Professional Experience: Graduate research assistant, Department of Entomology, Oklahoma State University, Stillwater, Oklahoma, 1980; Teaching Assistant, Department of Entomology, Oklahoma State University, Stillwater, Oklahoma, 1980.

Organization: Entomological Society of America and Society of American Foresters.