ANATOMICAL EFFECTS OF MECHANICAL DAMAGE ON CARYOPSES OF CHEAT (*BROMUS SECALINUS*)

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PREFACE

Wheat, and wheat research, is important to Oklahoma's economy. This study was conducted to provide data to support a proposed technique that is being developed for cheat control in wheat. The germination and viability of cheat caryopses are decreased due to the mechanical damage induced by a hammer mill and a roller mill. Physically, the florets exhibit small abrasions, cuts, and nicks. These damages appear to be the cause of the decrease in germination, but an anatomical study was required to determine the full extent of the damage. The objective of this study was to describe the effects of the mills on the anatomy of *Bromus secalinus* caryopses. This was accomplished by fixing, dehydrating, infiltrating, embedding, and sectioning intact, mill-damaged, and buried mill-damaged florets. Light microscopic observations of the sectioned florets were conducted to analyze the anatomical aspects of the damage on the caryopses.

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Anatomical Effects of Mechanical Damage on Caryopses of Cheat (*Bromus secalinus*)

Abstract. Germination and viability of cheat caryopses were decreased by mechanical damage induced by hammer and roller mills. Both loss of anatomical integrity and subsequent attack by fungi and nematodes contributed to this decrease. Passage of florets through the hammer mill removed most of the lemmas, paleas, and pericarps. Typically, the cuticular layer of the testa was the only remaining intact layer, and damage to the embryos and endosperm was severe. In contrast, passage of florets through a roller mill at settings of 5 and 8 cuts per centimeter and inter-roller gaps of 0.1 mm and 0.4 mm disrupted tissue organization of lemmas, paleas, and outer layers of the caryopses primarily at the cuts. Large gaps between the aleurone layer and testa, between testa and pericarp, and between the scutellum and endosperm were created. In the field, mill-damaged florets exhibited progressive degradation of anatomical organization the longer they were buried. Nematodes and fungi penetrated the caryopses and consumed embryos and endosperm. The proposed attachment of a hammer or roller mill to a grain combine could provide an efficient, economical, environmentally benign method of cheat control.

Nomenclature: cheat, *Bromus secalinus* L. #[1] BROSE.

Additional index words: florets, fungi, hammer mill, nematodes, roller mill

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[1]Letters following this symbol are a WSSA-approved computer code from Composite List of Weeds. Revised 1989. Available from WSSA, 1508 West University Ave., Champaign, IL 61821-3133.

CHAPTER I. INTRODUCTION

Cheat is a cespitose, C3, winter annual in the tribe Bromeae and subfamily Pooideae of the Poaceae (Clayton and Renvoize 1986). The species was introduced from Europe in the 1800's and is now widespread across the continent with plants found in grain fields, along roadsides, in meadows, and in waste areas. Flowering occurs in May and June. Although now considered a noxious weed by agronomists and farmers (Lorenzi and Jeffery 1987), it was used at one time as hay in Washington and Oregon (Hitchcock 1951). In Oklahoma and other wheat producing areas, cheat is a serious problem. It competes vigorously with wheat and causes significant reductions in yield (Nalewaja 1982), as well as economic penalties when producers are "docked" for excessive amounts in wheat being sold at elevators. The phenology of the two grasses is similar; the caryopses of both germinate in the fall, plants grow vegetatively through the winter, and then flower at approximately the same time in the spring. This similarity prevents efficient control (Lorenzi and Jeffery 1987). Current methods include the application of herbicides, moldboard plowing, burning of wheat stubble, and crop rotation. Each has its drawbacks.

A more efficient, environmentally sound, and economical method of cheat control in wheat is needed (Nalewaja 1982). An approach being developed at Oklahoma State University by Hauhouot, Solie and Peeper involves mechanically damaging the caryopses of cheat as they are harvested with those of wheat. It is proposed that a hammer mill or a roller mill attached to the combine be used to injure the caryopses and stop germination. Initial results revealed a decrease in the germination and vigor of cheat seedlings after florets and caryopses passed through either of the two mills. Although abrasions, nicks, and cuts were visible after passage (Figures 1a-1b), it was unknown exactly how the mills

were damaging the biological integrity of the caryopses and subsequently reducing germination and seedling vigor. The objective of this study was to document the effects of hammer and roller mills on the anatomy of the caryopses of cheat in order to determine whether mechanical damage to tissues was the cause of the decrease in germination.

CHAPTER II. MATERIALS AND METHODS

Florets (caryopses and enclosing lemmas and paleas) of cheat were collected with wheat during the wheat harvest of June, 1995 in agricultural research fields maintained by Oklahoma State University. Harvested by combine, they were separated from the wheat, transported to the laboratory, screened for intactness, divided into lots, passed through a hammer or roller mill, and planted in a field-germination study in July 1995. Voucher specimens were deposited in the OSU Herbarium (OKLA).

Intact florets were passed through a hammer mill[2] or a roller mill[3]. The hammer mill was equipped with a screen size of 0.48 cm holes and a maximum operating speed of 3600 RPM. Four settings of the roller mill, determined by previous lab-germination tests to produce maximum damage, were used. Roller mill settings were 5 cuts/cm and 8 cuts/cm of circumference (23 cm by 15 cm) with 0.1 mm and 0.4 mm gaps between rollers. The settings were designated 5 R 0.1, 5 R 0.4, 8 R 0.1, and 8 R 0.4.

A field study was conducted to determine the effects of the physical damage produced by the two mills on cheat germination. As the control, 600 intact florets, were divided into lots of 25, placed in 24 packets of screen-wire (.011 gauge fiberglass mesh cloth folded, 14 cm by 15 cm), and buried 5 cm deep in the soil of the two agricultural research fields, 12 packets in Stillwater, Ok and 12 packets in Perkins, Ok. Florets that passed through the hammer mill or each of the four settings of the roller mill were treated in the

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[2]Jay Bee Paper Disintegrator. Jay Bee Manufacturing Co., Inc. P.O. Box 986, Tyler, TX 75710

[3]H.C. Davis, Model 50 B. H. C. Davis Sons Manufacturing Co., Inc. Box 395, Bonner Springs, KS 66012

same fashion. In September, October, and December, four packets of each treatment (200 florets initially buried per treatment) were excavated, the florets extracted, counted, and visually inspected to determine whether they had germinated, and if so, the vigor of the seedlings.

Following inspection, all florets of each treatment were rinsed with distilled water, fixed in 2% glutaraldehyde / 2% formaldehyde buffered in 0.1M phosphate (pH 7.0) for 24 h at 4° C, soaked in 10% hydrochloric acid for 1 wk at 4° C, dehydrated for 24 h each with ethylene glycol monomethyl ether[4] followed by two changes of absolute ethanol. Florets to be sectioned were embedded in a glycol methacrylate polymer[5] and longitudinal sections 3 to 4 µm thick were cut with glass knives on an autocut microtome[6]. The sections were transferred to droplets of distilled water on cleaned, gelatin-coated glass slides; the water evaporated by gentle warming; and the sections stained using the periodic acid-leucobasic fuchsin (Schiff's) reaction and counterstained with 1% Naphthol blue-black[7] in 7% acetic acid (Clark 1981). The slides were then dipped briefly in 7% acetic acid to remove excess dye, air dried, mounted in an acrylic resin[8], and their anatomy examined using light microscopy. The number of caryopses sectioned per treatment

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[4]Methyl Cellosolve. Fisher Scientific, 711 Forbes Avenue, Pittsburgh, PA 15219-4785

[5]Historesin. Leica, Inc., 111 Deer Lake Road, Deerfield, IL 60015

[6]Jung RM 2045. Leica Instruments, Inc., GmbH, P. O. Box 1120, Heidelberger Str. 17-19 D-6907, Nusslock, Germany

[7]Amido Black 10B. Sigma Chemical Co., P.O. Box 14508, St. Louis, MO 63178

[8]Accu Mount 280. Baxter Healthcare Corp., Scientific Products Division. McGaw Park, IL 60085-6787

varied from 30 to 49. The morphology and anatomy of florets and caryopses not sectioned were examined using a binocular dissecting microscope.

Intact florets of cheat collected directly from the cleaned wheat and not treated in any way served as the control. They were prepared for microscopic observation in the same way as the mill-damaged and buried florets. The anatomical organization of the intact, non-treated caryopses, the mill-damaged caryopses, and the mill-damaged/buried caryopses were compared using light microscopy.

All excavated florets were classified into one of seven categories based on their morphological and anatomical appearance (Table 1).

F-tests from the analysis of variance procedure were used to test for differences in means due to main effects associated with locations, mechanical treatments, and months as well as any interactions which may be present. Data were pooled across the two locations when no interactions involving locations were present. Means were separated by Fisher's Protected Least Significant difference test. To avoid biases that would result from the large number of zeros in categories 5, 6, and 7 (Table 1) of the roller mill data, data from the hammer mill were analyzed separately.

CHAPTER III. RESULTS AND DISCUSSION

Morphology and anatomy of intact florets and caryopses. In cheat, the mature caryopsis tends to remain enclosed in its two subtending bracts, the lemma and palea; together the three constitute the floret (Figure 1c). Florets are borne in two ranks on an axis, the rachilla, and are partially subtended by a pair of glumes. Florets, rachilla, and glumes compose the spikelet, the grass family's characteristic morphological unit. When passing through the threshing unit of the grain combine, the spikelets of cheat disarticulate and the individual florets pass through the machinery. Examination of their morphology and anatomy revealed them to be intact and exhibiting normal organization of tissues.

The lemma, or outer bract of the floret, is seven-nerved and 6 to 8 mm long. It has a bifed apex with an awn approximately 7 mm long. The palea is membranous, tightly holds the caryopsis, has ciliate margins, is two-nerved, and is enveloped by the lemma. Passage through the combine did not disrupt the spatial organization of the lemmas, paleas, and their enclosed caryopses; or tear their tissues.

The embryo and endosperm of the caryopsis of cheat are enclosed within the pericarp and the testa which are fused together. The pericarp is composed of four layers: an outer epidermis covered with a cuticle; crushed parenchyma, several cells thick; transversely, elongated cross cells with thick lignified walls; and lignified tube cells (Rost 1973; Esau 1977). Derived from integuments, the testa comprises thick-walled cells that are covered with a thick, waxy cuticle, the cuticular layer (Rost 1973; Esau 1977; Hopkins 1995) (Figure 1d). Five harvested, intact florets were sectioned; microscopic examination revealed fungal spores, mycelia, and nematodes on the surfaces of the lemmas, paleas, and caryopses. They also were present in the layers of the pericarp, but were not observed

inside the cuticular layer of the testa (Figure 1e). These observations agree with previous work on the occurrence of nematodes and fungi in grasses (Cook and Yeates 1993).

The anatomy of a cheat caryopsis is typical of grasses with endosperm; a testa fused to the pericarp; and an embryo comprising scutellum, coleoptile, coleorhiza, epiblast, plumule and radicle (Brown 1960; Barnard 1964; Rost and Lersten 1973; Gould and Shaw 1983). Microscopic examination of the intact caryopses indicated typical tissue organization of the endosperm and embryo and surrounding layers (Figure 1f). The embryo is approximately 0.1 to 0.2 the length of the caryopsis and located in a basal position (Figure 2a).

The endosperm, composing the bulk of the caryopsis, is a triploid tissue produced by the fusion of the two polar nuclei of the embryo sac and a sperm nucleus. This centrally located tissue, nonliving at maturity, typically contains thin-walled cells filled with rounded starch grains characteristic of the Bromeae (Clayton and Renvoize 1986). The outermost layer of the endosperm, or aleurone, continues around the embryo.

The embryo axis consists of the plumule enclosed in the coleoptile and the radicle enclosed in the coleorhiza. Interpreted to be a cotyledon, the scutellum, which lies next to the endosperm, surrounds and is attached laterally to the embryonic axis by large vascular strands (Brown 1960; Simpson 1990).

Morphology and anatomy of mill-damaged florets and caryopses. Preliminary investigation revealed that passage of the florets through the hammer mill removed most of the lemma, palea, pericarp, and associated fungal spores and nematodes. Typically, the testa remained intact (Figure 2b). Small fragments of pericarp remained attached to the cuticular layer and contained fungal mycelia (Figure 2c). The anatomical organization of

the caryopsis's internal tissues was likewise disrupted. The entire plumule, or radicle, or scutellum typically was gone, or tissue from each was missing. Deep cuts into the endosperm tore cells apart and exposed the starch granules (Figure 2d).

In contrast, damage to the florets and caryopses was not as severe after passage through the roller mill. The tissue organization of the lemmas, paleas, and outer layers of the caryopses was disrupted only at the cuts produced by the rollers (Figure 2e). The cuts penetrated to varying depths through the lemma, palea, pericarp, aleurone layer, and into the endosperm and embryo. Embryos were present in all of the caryopses.

Severity of damage to the florets and caryopses varied with the roller mill's teeth spacing and inter-roller gap. Roller mill settings 5 R 0.4 and 8 R 0.4 produced large gaps between the aleurone layer and the testa, between the testa and the pericarp, and between the scutellum and endosperm (Figures 2f, 3a). Otherwise, the caryopses possessed typical tissue organization with embryos intact. The florets and caryopses damaged with roller mill settings of 5 R 0.1 and 8 R 0.1 exhibited deeper cuts through the lemmas, paleas, pericarps, aleurone layers, and into the endosperm allowing the cells and starch granules to be exposed (Figure 3b). Embryos at setting 5 R 0.1 typically were intact.

Fungal spores, mycelia, and nematodes were present in the lemmas, paleas, and throughout the layers of the pericarp. Their absence inside the cuticular layer of the testa and in the internal tissues was apparent.

Morphology and anatomy of buried, intact and mill-damaged florets. When buried, both the intact florets serving as the control and those damaged by the hammer and roller mills exhibited progressive degradation of anatomical organization (Table 2). Typically, the embryos degenerated first, followed by the endosperm, the aleurone layer, and then the

surrounding tissues of the pericarp/testa, palea, and lemma. This degradation appeared due to the activity of nematodes and the growth of fungi.

The control florets retained a higher perentage of intact lemmas, paleas, pericarp/testas surrounding intact embryos and endosperms than the mill-damaged florets. Twenty and nineteen percent of the control florets excavated in October and December were intact. The embryos of the control florets that had germinated before excavation exhibited elongation and emergence of the radicle, and development of the plumule. In contrast, the mill-damaged florets excavated at the same time had some fragments of internal tissue remaining that were not identifiable (Figure 3c). Florets damaged by the hammer mill still had their cuticular layer (pericarp and testa) in December, albeit some exhibited partial degeneration (Figure 3d). Likewise, the florets damaged by the roller mills had lemmas, paleas, and pericarp/testas at the first and second excavations, but at the third, they also showed signs of degeneration at the cuts.

Florets at settings 5 R 0.1 and 5 R 0.4 had less microscopically visible damage and more intact tissues than florets from settings 8 R 0.1 and 8 R 0.4, which were visibly damaged more. These observations agree with unpublished results of germination trials conducted by Hauhouot, Solie, and Peeper.

Sexual and asexual stages of fungi were observed both externally and internally in all caryopses at each excavation (Figure 3e). Nematodes at different stages in their life cycle were observed inside the florets and caryopses (Figure 3f). Their numbers varied with the amount of remaining tissue; the more that remained, the greater the number of nematodes observed.

Effects of mechanical damage on cheat. The effects of the hammer and roller mills on

the florets and caryopses of cheat are two. One, is disruption of the tissues required to maintain normal metabolic activity, permit germination, and facilitate seedling establishment. For example, the pericarp and testa play a significant role in regulating dormancy and germination by limiting gas and water exchange (Bradbeer 1988; Simpson 1990). The aleurone layer of the endosperm contains lipids and protein reserves, and produces enzymes essential for the initiation of germination (Rost and Lersten 1973; Esau 1977). It also produces hydrolytic enzymes required for starch degradation and production of sugars needed for embryo growth (Taiz and Zeiger 1991). Acting as a secretory and absorptive organ, the scutellum produces hormones that aid germination and enzymes for starch breakdown; it also is essential in transporting sugars from the endosperm to the meristems of the developing embryo and eventually the young sporophyte (Brown 1960; Rost and Lersten 1973; Esau 1977; Gould and Shaw 1983; Bradbeer 1988). As has been shown in this study, each of these essential tissues were damaged to varying degrees with subsequent effect on germination and seedling survival. The damage produced by the hammer and roller mills is a type of scarification (Bradbeer 1988), and our observations are consistent with those of Burton (1939), Cowly and Towers (1941), and Ahlgren, Fiske, and Dotzenko (1950) who reported that scarification can reduce the viability or inhibit germination of caryopses.

The second effect of the hammer and roller mills is a breaching of barriers to fungi and phytonematodes. The lemma, palea, pericarp, and especially the testa all provide protection against attack. Our observations revealed that intact florets and caryopses have fungal spores and nematodes associated with them, even when harvested and not in previous contact with the soil. They are, however, always outside the cuticular layer of

the testa. Breakage allows their penetration and the extent of internal degradation of tissue is directly proportional to the amount of mechanical damage inflicted by the mills and the length of time the caryopses are buried in the soil.

Nematode abundance varied with the amount of internal tissue present, at first high and then decreasing as it was consumed. The nematodes consumed first the embryo, then the endosperm and aleurone layer. The testa, pericarp, palea, and lemma typically were not eaten and persisted as a empty shell of the floret. When germination of both intact and mill-damaged caryopses occurred, the radicles of some were consumed by the nematodes. Rich in lipid and protein storage bodies, the radicle is surrounded by a mucilaginous layer which facilitates its passage through the soil, but gives little protection against predators (Rost and Lersten 1973). Sexual and asexual stages of fungi were observed both externally and internally in all caryopses at each excavation. At each consecutive excavation, more and more empty florets were consumed by mycelial growth.

It appears that damage, however slight, to the pericarp and testa of cheat caryopses reduces germination and viability. Thus, the proposed attachment of a hammer or roller mill to a combine can provide an efficient, economical, environmentally favorable method of cheat control.

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Table 2. Microscopically evident damage of cheat florets at three time intervals after mechanical treatment followed by burial at two locations.

		Location									
		Mean	Mean	Mean	Stw	Pks	Mean	Stw	Pks	Stw	Pks
		Microscopically evident damage[a]									
Mechanical treatment	Excavation month	L/P+ P/T+ E/E+	L/P+ P/T+ E/E-	L/P+ P/T- E/E-	L/P(+) P/T- E/E-		L/P- P/T+ E/E+	L/P- P/T+ E/E-		L/P- P/T(+) E/E-	
		% florets recovered									
Intact (control)	September	70.6	15.3	6.3	3.8	4.2	0.0	0.0	0.0	0.0	0.0
	October	20.6	58.9	6.5	1.0	13.0	0.0	0.0	0.0	0.0	0.0
	December	19.8	52.6	6.6	10.0	11.0	0.0	0.0	0.0	0.0	0.0
Roller mill 5 R 0.1	September	10.1	55.6	28.9	1.8	3.7	0.0	0.0	0.0	0.0	0.0
	October	6.6	69.0	16.8	2.7	4.0	0.5	0.5	0.0	0.0	0.0
	December	1.8	28.8	41.8	6.5	19.0	0.0	0.7	1.0	0.0	0.7
Roller mill 5 R 0.4	September	20.3	50.3	16.6	9.0	1.2	0.6	0.0	0.9	0.0	0.0
	October	10.3	52.4	18.0	3.9	14.2	0.5	0.9	0.0	0.0	0.0
	December	4.3	43.1	25.0	8.0	17.7	0.5	0.5	0.5	0.0	0.5
Roller mill 8 R 0.1	September	4.8	47.6	41.8	1.0	3.9	0.5	0.0	0.5	0.0	0.0
	October	2.9	60.5	20.1	3.0	12.5	0.5	0.0	0.5	0.0	0.0
	December	0.0	20.6	40.8	22.8	14.4	0.5	0.0	0.5	0.5	0.0

Roller mill 8 R 0.4	September	6.9	71.5	17.5	2.7	1.5	0.0	0.0	0.0	0.0	0.0
	October	2.1	62.9	24.3	3.2	6.7	0.5	0.0	0.5	0.0	0.0
	December	0.0	30.4	51.0	10.7	7.5	0.0	0.0	0.0	0.5	0.0
Hammer mill	September	1.6	0.5	0.0	0.5	0.7	7.8	42.2	44.5	1.2	1.3
	October	0.6	6.5	0.0	0.0	0.5	43.2	32.7	0.5	2.3	13.8
	December	0.0	11.1	0.5	0.0	0.7	0.5	20.4	29.9	21.4	15.7
LSD (0.05)		7.4	12.8	10.3	16.1	16.1	6.5[b]	25.4[b]	25.4[b]	25.3[b]	25.3[b]

a. Abbreviations: lemma (L) / palea (P); pericarp (P) / testa (T); embryo (E) / endosperm (E); present (+); absent (-); disintegrating {(+)}; see table 1 for notations.
b. LSD values for comparing hammer mill data only.

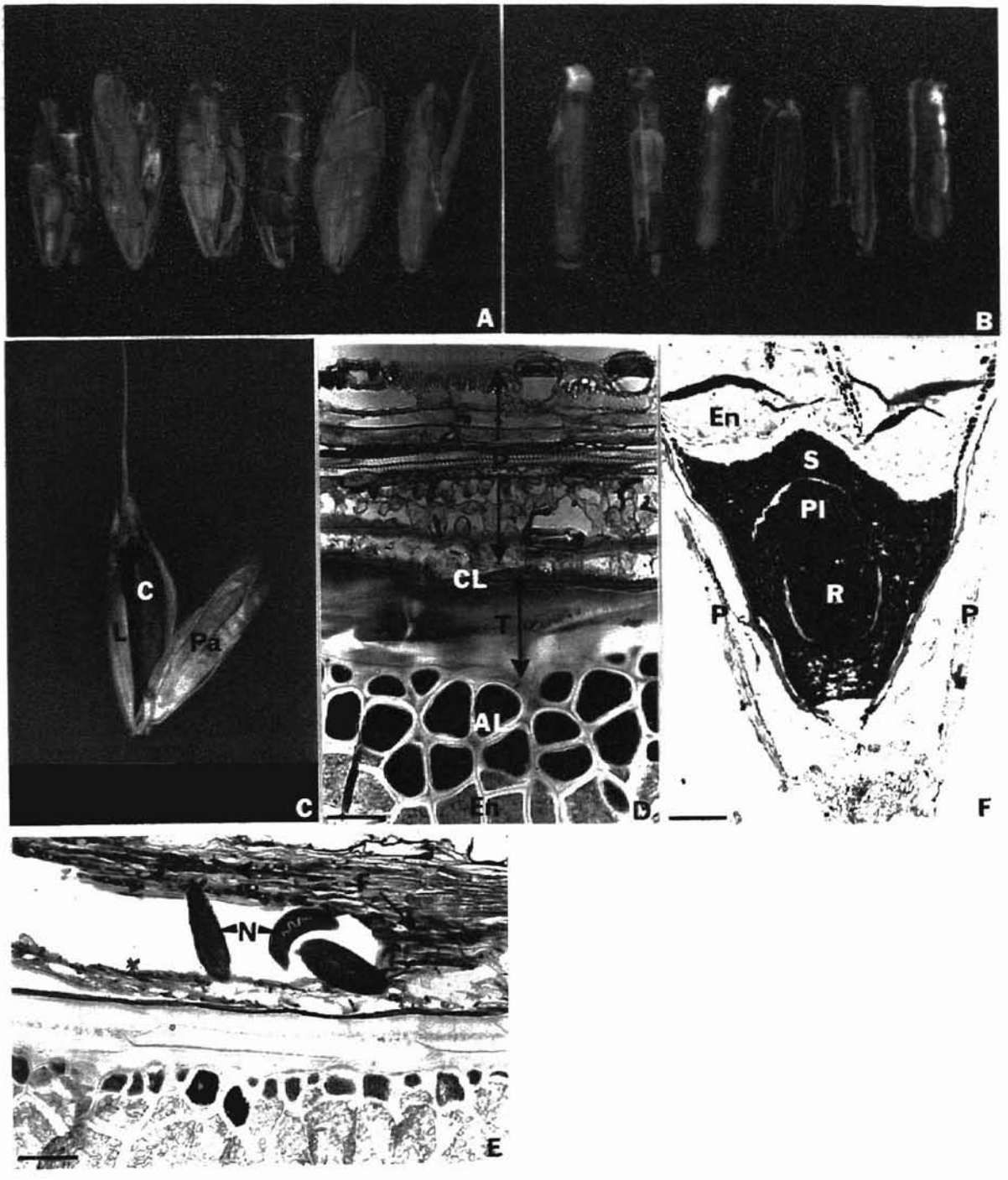
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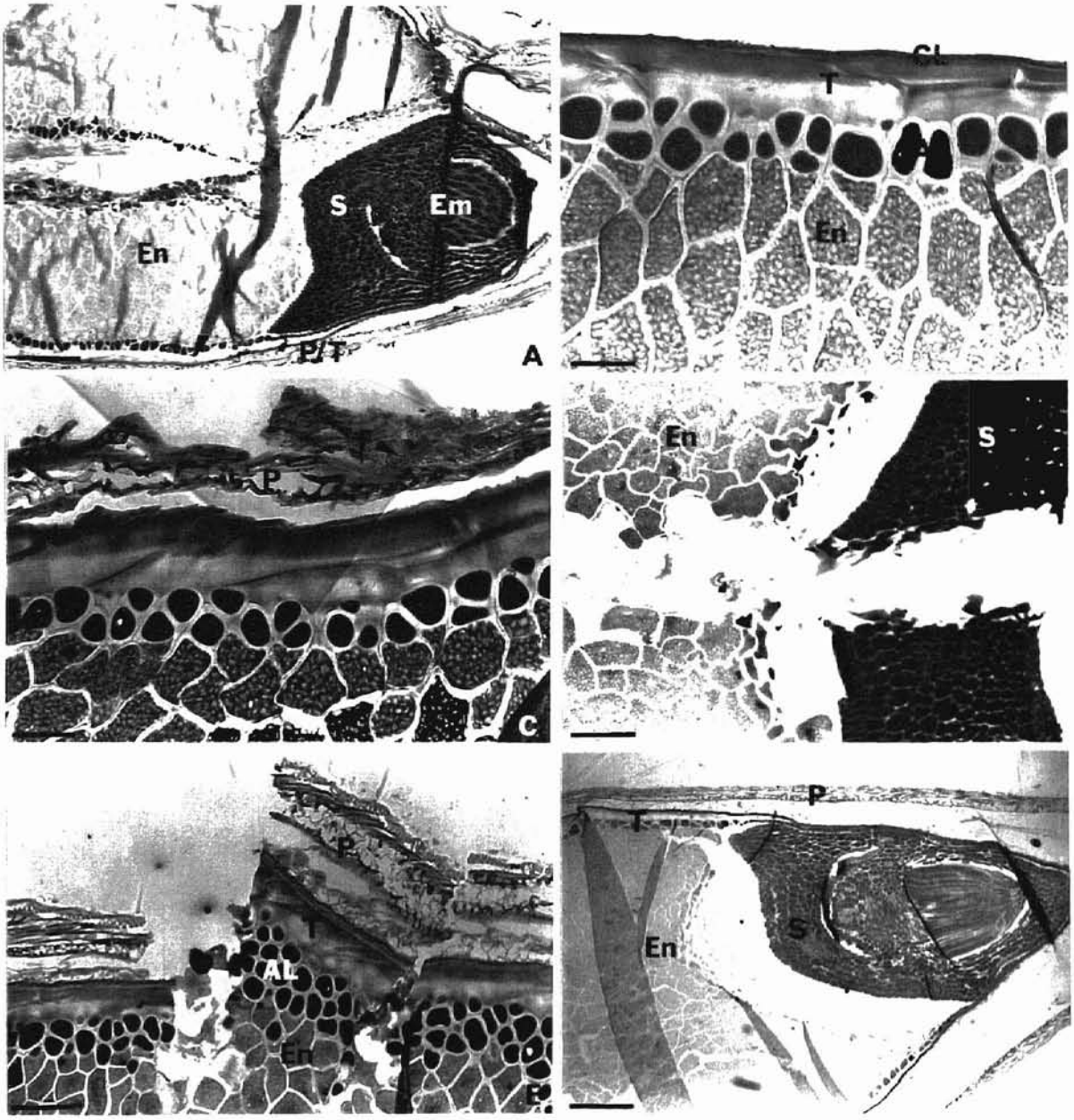
Figure 2. A) Longitudinal section of caryopsis showing embryo position, scutellum, endosperm, and pericarp/testa. Bar = 300μm. B) Longitudinal section of hammer mill-damaged caryopsis showing loss of lemma, palea, and pericarp; intact cuticular layer, testa, aleurone layer, and endosperm intact. Bar = 88 μm. C) Longitudinal section of hammer mill-damaged caryopsis showing fragment of pericarp with fungi. Bar = 88 μm. D) Longitudinal section of hammer mill-damaged caryopsis showing cut penetrating scutellum and endosperm. Bar = 144 μm. E) Longitudinal section of roller mill-damaged floret showing cut penetrating pericarp, testa, aleurone layer, and endosperm. Bar = 144 μm. F) Longitudinal section of roller mill-damaged caryopsis showing gap between scutellum and endosperm and between pericarp and testa. Bar = 300 μm. Aleurone layer (AL), cuticular layer (CL), embryo (Em), endosperm (En), fungi (F), pericarp (P), scutellum (S), testa (T).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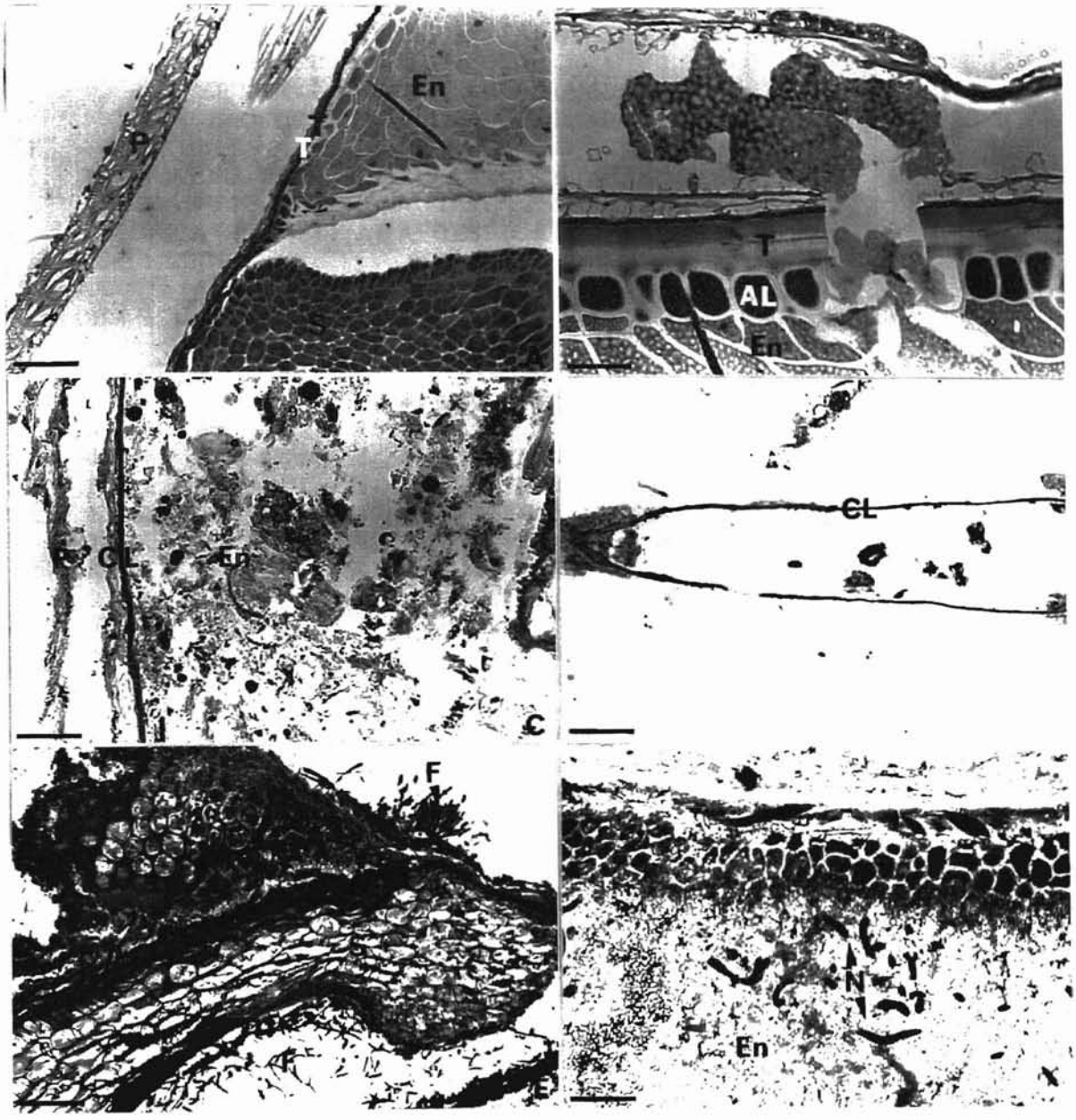
En

Figure 3. A) Longitudinal section of roller mill-damaged caryopsis showing gap between scutellum and endosperm and between pericarp and testa. Bar = 144 μm. B) Longitudinal section showing cut penetrating testa, aleurone layer, and endosperm, and exposing cells and starch granules. Bar = 88 μm. C) Longitudinal section of roller mill-damaged caryopsis showing degenerating endosperm, intact cuticular layer, and pericarp. Bar = 88 μm. D) Longitudinal section of hammer mill-damaged caryopsis showing cuticular layer and absence of embryo and endosperm. Bar = 300 μm. E) Longitudinal section of roller mill-damaged caryopsis showing fungal spores and mycelia inside and surrounding scutellum. Bar = 144 μm. F) Longitudinal section of roller mill-damaged caryopsis showing nematodes in endosperm. Bar = 144 μm. Aleurone layer (AL), cuticular layer (CL), endosperm (En), fungi (F), nematodes (N), pericarp (P), scutellum (S), testa (T).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N

APPENDIX A: ANALYSES OF VARIANCE OF ROLLER MILL DATA

SEE 'REONNA1X.CTD' FOR PROGRAM FILE!
CHARACTERISTICS: LEMMA/PALEA, PERICARP/TESTA, & EMBRYO/ENDOSPERM

1

INDICATORS: P - PRESENT, A - ABSENT, & D - DISENTEGRATING
TEST A: P P P. TEST B: P P A. TEST C: P A A. TEST D: D A A.
TEST E: A P P. TEST F: A P A. TEST G: A D A.
08:32 Monday, April 14, 1997

OBS	LOCN	TRTMT	MONTH	TEST	N	MEAN	STD	MIN	MAX
1	PK	5R1	DEC	A	4	0.00	0.0000	0	0
2	PK	5R1	OCT	A	4	5.50	5.4467	0	13
3	PK	5R1	SEPT	A	4	9.25	0.9574	8	10
4	PK	5R4	DEC	A	4	2.25	2.6300	0	5
5	PK	5R4	OCT	A	4	9.00	3.8297	4	12
6	PK	5R4	SEPT	A	4	22.25	3.5940	19	27
7	PK	8R1	DEC	A	4	0.00	0.0000	0	0
8	PK	8R1	OCT	A	4	2.25	2.6300	0	5
9	PK	8R1	SEPT	A	4	5.50	4.3589	0	9
10	PK	8R4	DEC	A	4	0.00	0.0000	0	0
11	PK	8R4	OCT	A	4	1.00	2.0000	0	4
12	PK	8R4	SEPT	A	4	9.50	7.5498	0	18
13	PK	CONT	DEC	A	4	16.50	5.1962	10	22
14	PK	CONT	OCT	A	4	13.75	4.9917	10	21
15	PK	CONT	SEPT	A	4	67.00	23.7065	33	87
16	PK	HAM	DEC	A	4	0.00	0.0000	0	0
17	PK	HAM	OCT	A	4	0.00	0.0000	0	0
18	PK	HAM	SEPT	A	4	1.25	2.5000	0	5
19	STW	5R1	DEC	A	4	3.50	2.3805	0	5
20	STW	5R1	OCT	A	4	7.75	7.1822	0	17
21	STW	5R1	SEPT	A	4	11.00	4.6904	4	14
22	STW	5R4	DEC	A	4	6.25	5.3151	0	12
23	STW	5R4	OCT	A	4	11.50	4.4347	7	17
24	STW	5R4	SEPT	A	4	18.25	7.4554	9	27
25	STW	8R1	DEC	A	4	0.00	0.0000	0	0
26	STW	8R1	OCT	A	4	3.50	4.7258	0	10
27	STW	8R1	SEPT	A	4	4.00	4.6188	0	8
28	STW	8R4	DEC	A	4	0.00	0.0000	0	0
29	STW	8R4	OCT	A	4	3.25	2.2174	0	5
30	STW	8R4	SEPT	A	4	4.25	3.3040	0	8
31	STW	CONT	DEC	A	4	23.00	14.4453	4	38
32	STW	CONT	OCT	A	4	27.50	24.1868	8	62
33	STW	CONT	SEPT	A	4	74.25	14.2916	57	86
34	STW	HAM	DEC	A	4	0.00	0.0000	0	0
35	STW	HAM	OCT	A	4	1.25	2.5000	0	5
36	STW	HAM	SEPT	A	4	2.00	2.3094	0	4
37	PK	5R1	DEC	B	4	14.50	9.0370	4	23
38	PK	5R1	OCT	B	4	65.00	17.6257	50	90
39	PK	5R1	SEPT	B	4	55.00	6.6332	50	64
40	PK	5R4	DEC	B	4	30.25	3.2016	28	35
41	PK	5R4	OCT	B	4	37.50	17.2337	12	50
42	PK	5R4	SEPT	B	4	59.50	10.3441	50	73
43	PK	8R1	DEC	B	4	20.25	9.1059	10	32

44	PK	8R1	OCT	B	4	49.50	19.3649	36	78
45	PK	8R1	SEPT	B	4	50.50	11.4746	36	64
46	PK	8R4	DEC	B	4	31.50	11.7047	18	44
47	PK	8R4	OCT	B	4	57.75	11.6440	41	67
48	PK	8R4	SEPT	B	4	78.50	15.2643	64	100
49	PK	CONT	DEC	B	4	53.75	13.2508	43	72
50	PK	CONT	OCT	B	4	54.75	17.6139	39	70
51	PK	CONT	SEPT	B	4	17.50	5.2599	13	25
52	PK	HAM	DEC	B	4	6.75	8.3016	0	17
53	PK	HAM	OCT	B	4	6.25	4.5000	4	13
54	PK	HAM	SEPT	B	4	0.00	0.0000	0	0
55	STW	5R1	DEC	B	4	43.00	16.6933	26	66
56	STW	5R1	OCT	B	4	73.00	10.8012	61	87
57	STW	5R1	SEPT	B	4	56.25	11.3248	45	66
58	STW	5R4	DEC	B	4	56.00	8.2865	48	65
59	STW	5R4	OCT	B	4	67.25	12.5000	50	79
60	STW	5R4	SEPT	B	4	41.00	23.6220	9	66
61	STW	8R1	DEC	B	4	21.00	9.6954	14	35
62	STW	8R1	OCT	B	4	71.50	5.9161	63	76
63	STW	8R1	SEPT	B	4	44.75	16.2763	28	65
64	STW	8R4	DEC	B	4	29.25	10.6575	17	43

CHARACTERISTICS: LEMMA/PALEA, PERICARP/TESTA, & EMBRYO/ENDOSPERM

2

INDICATORS: P - PRESENT, A - ABSENT, & D - DISENTEGRATING
TEST A: P P P. TEST B: P P A. TEST C: P A A. TEST D: D A A.
TEST E: A P P. TEST F: A P A. TEST G: A D A.

08:32 Monday, April 14, 1997

OBS	LOCN	TRTMT	MONTH	TEST	N	MEAN	STD	MIN	MAX
65	STW	8R4	OCT	B	4	68.00	11.7757	56	84
66	STW	8R4	SEPT	B	4	64.50	18.0831	44	86
67	STW	CONT	DEC	B	4	51.50	21.9317	31	79
68	STW	CONT	OCT	B	4	63.00	23.5797	38	86
69	STW	CONT	SEPT	B	4	13.00	2.9439	9	16
70	STW	HAM	DEC	B	4	15.50	4.6547	10	21
71	STW	HAM	OCT	B	4	6.75	7.2284	0	17
72	STW	HAM	SEPT	B	4	1.00	2.0000	0	4
73	PK	5R1	DEC	C	4	44.25	8.6939	35	55
74	PK	5R1	OCT	C	4	20.50	12.5565	5	33
75	PK	5R1	SEPT	C	4	28.50	7.5498	18	36
76	PK	5R4	DEC	C	4	30.25	17.7083	9	50
77	PK	5R4	OCT	C	4	24.25	11.7863	12	40
78	PK	5R4	SEPT	C	4	11.75	10.9962	0	23
79	PK	8R1	DEC	C	4	49.00	8.8318	40	58
80	PK	8R1	OCT	C	4	22.25	13.1498	9	40
81	PK	8R1	SEPT	C	4	34.25	13.1751	22	52
82	PK	8R4	DEC	C	4	53.50	14.0594	40	68
83	PK	8R4	OCT	C	4	27.00	5.8310	21	32
84	PK	8R4	SEPT	C	4	9.00	8.2462	0	16
85	PK	CONT	DEC	C	4	7.75	11.8427	0	25
86	PK	CONT	OCT	C	4	5.50	6.5574	0	13
87	PK	CONT	SEPT	C	4	7.25	8.1803	0	19
88	PK	HAM	DEC	C	4	0.00	0.0000	0	0
89	PK	HAM	OCT	C	4	0.00	0.0000	0	0

90	PK	HAM	SEPT	C	4	0.00	0.0000	0	0
91	STW	5R1	DEC	C	4	39.25	19.7210	10	52
92	STW	5R1	OCT	C	4	13.00	10.4881	0	22
93	STW	5R1	SEPT	C	4	29.25	16.5202	10	44
94	STW	5R4	DEC	C	4	19.75	9.4296	13	33
95	STW	5R4	OCT	C	4	11.75	6.8496	8	22
96	STW	5R4	SEPT	C	4	21.50	5.0662	17	28
97	STW	8R1	DEC	C	4	32.50	14.5258	20	53
98	STW	8R1	OCT	C	4	18.00	6.2716	10	25
99	STW	8R1	SEPT	C	4	49.25	15.4785	31	64
100	STW	8R4	DEC	C	4	48.50	8.2664	40	57
101	STW	8R4	OCT	C	4	21.50	11.7047	8	36
102	STW	8R4	SEPT	C	4	26.00	12.5698	9	36
103	STW	CONT	DEC	C	4	5.50	5.0000	0	12
104	STW	CONT	OCT	C	4	7.50	12.4766	0	26
105	STW	CONT	SEPT	C	4	5.25	3.7749	0	8
106	STW	HAM	DEC	C	4	1.00	2.0000	0	4
107	STW	HAM	OCT	C	4	1.00	2.0000	0	4
108	STW	HAM	SEPT	C	4	0.00	0.0000	0	0
109	PK	5R1	DEC	D	4	38.00	16.7929	18	57
110	PK	5R1	OCT	D	4	8.00	13.4660	0	28
111	PK	5R1	SEPT	D	4	7.25	4.8563	0	10
112	PK	5R4	DEC	D	4	35.25	14.9750	17	48
113	PK	5R4	OCT	D	4	28.25	25.4083	4	64
114	PK	5R4	SEPT	D	4	2.25	2.6300	0	5
115	PK	8R1	DEC	D	4	28.75	9.9457	21	43
116	PK	8R1	OCT	D	4	25.00	17.8699	5	48
117	PK	8R1	SEPT	D	4	7.75	1.8930	5	9
118	PK	8R4	DEC	D	4	15.00	3.3665	11	19
119	PK	8R4	OCT	D	4	13.25	11.2953	4	27
120	PK	8R4	SEPT	D	4	3.00	3.8297	0	8
121	PK	CONT	DEC	D	4	22.00	16.4114	0	38
122	PK	CONT	OCT	D	4	26.00	27.7609	0	50
123	PK	CONT	SEPT	D	4	8.25	16.5000	0	33
124	PK	HAM	DEC	D	4	1.25	2.5000	0	5
125	PK	HAM	OCT	D	4	0.00	0.0000	0	0
126	PK	HAM	SEPT	D	4	1.25	2.5000	0	5
127	STW	5R1	DEC	D	4	13.00	5.5976	5	18
128	STW	5R1	OCT	D	4	5.25	8.0571	0	17

CHARACTERISTICS: LEMMA/PALEA, PERICARP/TESTA, & EMBRYO/ENDOSPERM

3

INDICATORS: P - PRESENT, A - ABSENT, & D - DISENTEGRATING
TEST A: P P P. TEST B: P P A. TEST C: P A A. TEST D: D A A.
TEST E: A P P. TEST F: A P A. TEST G: A D A.

08:32 Monday, April 14, 1997

OBS	LOCN	TRTMT	MONTH	TEST	N	MEAN	STD	MIN	MAX
129	STW	5R1	SEPT	D	4	3.50	4.7258	0	10
130	STW	5R4	DEC	D	4	16.00	2.1602	13	18
131	STW	5R4	OCT	D	4	7.75	5.7951	0	14
132	STW	5R4	SEPT	D	4	18.00	20.0666	0	46
133	STW	8R1	DEC	D	4	45.50	10.8474	33	56
134	STW	8R1	OCT	D	4	6.00	5.1640	0	12
135	STW	8R1	SEPT	D	4	2.00	2.3094	0	4

136	STW	8R4	DEC	D	4	21.25	8.8459	14	32
137	STW	8R4	OCT	D	4	6.25	5.3151	0	12
138	STW	8R4	SEPT	D	4	5.25	7.5443	0	16
139	STW	CONT	DEC	D	4	20.00	17.8699	0	42
140	STW	CONT	OCT	D	4	2.00	4.0000	0	8
141	STW	CONT	SEPT	D	4	7.50	10.3763	0	22
142	STW	HAM	DEC	D	4	0.00	0.0000	0	0
143	STW	HAM	OCT	D	4	0.00	0.0000	0	0
144	STW	HAM	SEPT	D	4	1.00	2.0000	0	4
145	PK	5R1	DEC	E	4	0.00	0.0000	0	0
146	PK	5R1	OCT	E	4	1.00	2.0000	0	4
147	PK	5R1	SEPT	E	4	0.00	0.0000	0	0
148	PK	5R4	DEC	E	4	0.00	0.0000	0	0
149	PK	5R4	OCT	E	4	1.00	2.0000	0	4
150	PK	5R4	SEPT	E	4	0.00	0.0000	0	0
151	PK	8R1	DEC	E	4	1.00	2.0000	0	4
152	PK	8R1	OCT	E	4	0.00	0.0000	0	0
153	PK	8R1	SEPT	E	4	1.00	2.0000	0	4
154	PK	8R4	DEC	E	4	0.00	0.0000	0	0
155	PK	8R4	OCT	E	4	0.00	0.0000	0	0
156	PK	8R4	SEPT	E	4	0.00	0.0000	0	0
157	PK	CONT	DEC	E	4	0.00	0.0000	0	0
158	PK	CONT	OCT	E	4	0.00	0.0000	0	0
159	PK	CONT	SEPT	E	4	0.00	0.0000	0	0
160	PK	HAM	DEC	E	4	1.00	2.0000	0	4
161	PK	HAM	OCT	E	4	1.00	2.0000	0	4
162	PK	HAM	SEPT	E	4	6.00	4.5461	0	10
163	STW	5R1	DEC	E	4	0.00	0.0000	0	0
164	STW	5R1	OCT	E	4	0.00	0.0000	0	0
165	STW	5R1	SEPT	E	4	0.00	0.0000	0	0
166	STW	5R4	DEC	E	4	1.00	2.0000	0	4
167	STW	5R4	OCT	E	4	0.00	0.0000	0	0
168	STW	5R4	SEPT	E	4	1.25	2.5000	0	5
169	STW	8R1	DEC	E	4	0.00	0.0000	0	0
170	STW	8R1	OCT	E	4	1.00	2.0000	0	4
171	STW	8R1	SEPT	E	4	0.00	0.0000	0	0
172	STW	8R4	DEC	E	4	0.00	0.0000	0	0
173	STW	8R4	OCT	E	4	1.00	2.0000	0	4
174	STW	8R4	SEPT	E	4	0.00	0.0000	0	0
175	STW	CONT	DEC	E	4	0.00	0.0000	0	0
176	STW	CONT	OCT	E	4	0.00	0.0000	0	0
177	STW	CONT	SEPT	E	4	0.00	0.0000	0	0
178	STW	HAM	DEC	E	4	0.00	0.0000	0	0
179	STW	HAM	OCT	E	4	0.00	0.0000	0	0
180	STW	HAM	SEPT	E	4	9.50	8.6603	0	21
181	PK	5R1	DEC	F	4	2.00	2.3094	0	4
182	PK	5R1	OCT	F	4	0.00	0.0000	0	0
183	PK	5R1	SEPT	F	4	0.00	0.0000	0	0
184	PK	5R4	DEC	F	4	1.00	2.0000	0	4
185	PK	5R4	OCT	F	4	0.00	0.0000	0	0
186	PK	5R4	SEPT	F	4	1.75	3.5000	0	7
187	PK	8R1	DEC	F	4	1.00	2.0000	0	4
188	PK	8R1	OCT	F	4	1.00	2.0000	0	4
189	PK	8R1	SEPT	F	4	1.00	2.0000	0	4
190	PK	8R4	DEC	F	4	0.00	0.0000	0	0

191	PK	8R4	OCT	F	4	1.00	2.0000	0	4
192	PK	8R4	SEPT	F	4	0.00	0.0000	0	0

CHARACTERISTICS: LEMMA/PALEA, PERICARP/TESTA, & EMBRYO/ENDOSPERM
4

INDICATORS: P - PRESENT, A - ABSENT, & D - DISENTEGRATING
TEST A: P P P. TEST B: P P A. TEST C: P A A. TEST D: D A A.
TEST E: A P P. TEST F: A P A. TEST G: A D A.

08:32 Monday, April 14, 1997

OBS	LOCN	TRTMT	MONTH	TEST	N	MEAN	STD	MIN	MAX
193	PK	CONT	DEC	F	4	0.00	0.0000	0	0
194	PK	CONT	OCT	F	4	0.00	0.0000	0	0
195	PK	CONT	SEPT	F	4	0.00	0.0000	0	0
196	PK	HAM	DEC	F	4	59.75	13.8173	50	80
197	PK	HAM	OCT	F	4	65.25	13.6473	46	78
198	PK	HAM	SEPT	F	4	89.00	9.8658	76	100
199	STW	5R1	DEC	F	4	1.25	2.5000	0	5
200	STW	5R1	OCT	F	4	1.00	2.0000	0	4
201	STW	5R1	SEPT	F	4	0.00	0.0000	0	0
202	STW	5R4	DEC	F	4	1.00	2.0000	0	4
203	STW	5R4	OCT	F	4	1.75	3.5000	0	7
204	STW	5R4	SEPT	F	4	0.00	0.0000	0	0
205	STW	8R1	DEC	F	4	0.00	0.0000	0	0
206	STW	8R1	OCT	F	4	0.00	0.0000	0	0
207	STW	8R1	SEPT	F	4	0.00	0.0000	0	0
208	STW	8R4	DEC	F	4	0.00	0.0000	0	0
209	STW	8R4	OCT	F	4	0.00	0.0000	0	0
210	STW	8R4	SEPT	F	4	0.00	0.0000	0	0
211	STW	CONT	DEC	F	4	0.00	0.0000	0	0
212	STW	CONT	OCT	F	4	0.00	0.0000	0	0
213	STW	CONT	SEPT	F	4	0.00	0.0000	0	0
214	STW	HAM	DEC	F	4	40.75	25.9406	10	66
215	STW	HAM	OCT	F	4	86.50	8.1854	79	95
216	STW	HAM	SEPT	F	4	84.25	11.6154	75	100
217	PK	5R1	DEC	G	4	1.25	2.5000	0	5
218	PK	5R1	OCT	G	4	0.00	0.0000	0	0
219	PK	5R1	SEPT	G	4	0.00	0.0000	0	0
220	PK	5R4	DEC	G	4	1.00	2.0000	0	4
221	PK	5R4	OCT	G	4	0.00	0.0000	0	0
222	PK	5R4	SEPT	G	4	0.00	0.0000	0	0
223	PK	8R1	DEC	G	4	0.00	0.0000	0	0
224	PK	8R1	OCT	G	4	0.00	0.0000	0	0
225	PK	8R1	SEPT	G	4	0.00	0.0000	0	0
226	PK	8R4	DEC	G	4	0.00	0.0000	0	0
227	PK	8R4	OCT	G	4	0.00	0.0000	0	0
228	PK	8R4	SEPT	G	4	0.00	0.0000	0	0
229	PK	CONT	DEC	G	4	0.00	0.0000	0	0
230	PK	CONT	OCT	G	4	0.00	0.0000	0	0
231	PK	CONT	SEPT	G	4	0.00	0.0000	0	0
232	PK	HAM	DEC	G	4	31.25	15.3487	15	48
233	PK	HAM	OCT	G	4	27.50	13.4784	17	46
234	PK	HAM	SEPT	G	4	2.50	2.8868	0	5
235	STW	5R1	DEC	G	4	0.00	0.0000	0	0
236	STW	5R1	OCT	G	4	0.00	0.0000	0	0

237	STW	5R1	SEPT	G	4	0.00	0.0000	0	0
238	STW	5R4	DEC	G	4	0.00	0.0000	0	0
239	STW	5R4	OCT	G	4	0.00	0.0000	0	0
240	STW	5R4	SEPT	G	4	0.00	0.0000	0	0
241	STW	8R1	DEC	G	4	1.00	2.0000	0	4
242	STW	8R1	OCT	G	4	0.00	0.0000	0	0
243	STW	8R1	SEPT	G	4	0.00	0.0000	0	0
244	STW	8R4	DEC	G	4	1.00	2.0000	0	4
245	STW	8R4	OCT	G	4	0.00	0.0000	0	0
246	STW	8R4	SEPT	G	4	0.00	0.0000	0	0
247	STW	CONT	DEC	G	4	0.00	0.0000	0	0
248	STW	CONT	OCT	G	4	0.00	0.0000	0	0
249	STW	CONT	SEPT	G	4	0.00	0.0000	0	0
250	STW	HAM	DEC	G	4	42.75	31.1809	17	80
251	STW	HAM	OCT	G	4	4.50	5.2599	0	10
252	STW	HAM	SEPT	G	4	2.25	2.6300	0	5

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
5

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=A ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4
TRTMT	6	5R1 5R4 8R1 8R4 CONT HAM
MONTH	3	DEC OCT SEPT

Number of observations in by group = 144

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
6

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=A ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	38843.61805556	947.40531843	17.08	0.0001

Error	102	5659.04166667	55.48080065
Corrected Total	143	44502.65972222	

R-Square	C.V.	Root MSE	FLORETS Mean
0.872838	73.21435	7.44854353	10.17361111

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	146.00694444	146.00694444	2.63	0.1078
ROW(LOCN)	6	412.70833333	68.78472222	1.24	0.2923
TRTMT	5	22469.03472222	4493.80694444	81.00	0.0001
LOCN*TRTMT	5	408.53472222	81.70694444	1.47	0.2053
MONTH	2	5863.51388889	2931.75694444	52.84	0.0001
LOCN*MONTH	2	99.84722222	49.92361111	0.90	0.4098
TRTMT*MONTH	10	9336.23611111	933.62361111	16.83	0.0001
LOCN*TRTMT*MONTH	10	107.73611111	10.77361111	0.19	0.9964

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	146.00694444	146.00694444	2.12	0.1954

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
7

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=A ----------

General Linear Models Procedure
Least Squares Means

TRTMT	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
5R1	DEC	1.7500000	2.6334578	0.5079	1
5R1	OCT	6.6250000	2.6334578	0.0134	2
5R1	SEPT	10.1250000	2.6334578	0.0002	3
5R4	DEC	4.2500000	2.6334578	0.1097	4
5R4	OCT	10.2500000	2.6334578	0.0002	5
5R4	SEPT	20.2500000	2.6334578	0.0001	6
8R1	DEC	0.0000000	2.6334578	1.0000	7
8R1	OCT	2.8750000	2.6334578	0.2775	8
8R1	SEPT	4.7500000	2.6334578	0.0742	9
8R4	DEC	-0.0000000	2.6334578	1.0000	10
8R4	OCT	2.1250000	2.6334578	0.4216	11
8R4	SEPT	6.8750000	2.6334578	0.0104	12
CONT	DEC	19.7500000	2.6334578	0.0001	13
CONT	OCT	20.6250000	2.6334578	0.0001	14

CONT	SEPT	70.6250000	2.6334578	0.0001	15
HAM	DEC	0.0000000	2.6334578	1.0000	16
HAM	OCT	0.6250000	2.6334578	0.8129	17
HAM	SEPT	1.6250000	2.6334578	0.5386	18

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7	8	9	10	11
1	.	0.1935	0.0267	0.5036	0.0245	0.0001	0.6394	0.7632	0.4224	0.6394	0.9200
2	0.1935	.	0.3496	0.5251	0.3327	0.0004	0.0782	0.3164	0.6157	0.0782	0.2297
3	0.0267	0.3496	.	0.1178	0.9733	0.0077	0.0077	0.0543	0.1520	0.0077	0.0341
4	0.5036	0.5251	0.1178	.	0.1103	0.0001	0.2565	0.7127	0.8935	0.2565	0.5695
5	0.0245	0.3327	0.9733	0.1103	.	0.0085	0.0070	0.0504	0.1428	0.0070	0.0314
6	0.0001	0.0004	0.0077	0.0001	0.0085	.	0.0001	0.0001	0.0001	0.0001	0.0001
7	0.6394	0.0782	0.0077	0.2565	0.0070	0.0001	.	0.4419	0.2051	1.0000	0.5695
8	0.7632	0.3164	0.0543	0.7127	0.0504	0.0001	0.4419	.	0.6157	0.4419	0.8408
9	0.4224	0.6157	0.1520	0.8935	0.1428	0.0001	0.2051	0.6157	.	0.2051	0.4825
10	0.6394	0.0782	0.0077	0.2565	0.0070	0.0001	1.0000	0.4419	0.2051	.	0.5695
11	0.9200	0.2297	0.0341	0.5695	0.0314	0.0001	0.5695	0.8408	0.4825	0.5695	.
12	0.1718	0.9466	0.3849	0.4825	0.3670	0.0005	0.0678	0.2853	0.5695	0.0678	0.2051
13	0.0001	0.0006	0.0112	0.0001	0.0122	0.8935	0.0001	0.0001	0.0001	0.0001	0.0001
14	0.0001	0.0003	0.0058	0.0001	0.0064	0.9200	0.0001	0.0001	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
16	0.6394	0.0782	0.0077	0.2565	0.0070	0.0001	1.0000	0.4419	0.2051	1.0000	0.5695
17	0.7632	0.1103	0.0122	0.3327	0.0112	0.0001	0.8671	0.5471	0.2706	0.8671	0.6880
18	0.9733	0.1824	0.0245	0.4825	0.0226	0.0001	0.6635	0.7378	0.4034	0.6635	0.8935

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	12	13	14	15	16	17	18
1	0.1718	0.0001	0.0001	0.0001	0.6394	0.7632	0.9733
2	0.9466	0.0006	0.0003	0.0001	0.0782	0.1103	0.1824
3	0.3849	0.0112	0.0058	0.0001	0.0077	0.0122	0.0245
4	0.4825	0.0001	0.0001	0.0001	0.2565	0.3327	0.4825
5	0.3670	0.0122	0.0064	0.0001	0.0070	0.0112	0.0226
6	0.0005	0.8935	0.9200	0.0001	0.0001	0.0001	0.0001
7	0.0678	0.0001	0.0001	0.0001	1.0000	0.8671	0.6635
8	0.2853	0.0001	0.0001	0.0001	0.4419	0.5471	0.7378
9	0.5695	0.0001	0.0001	0.0001	0.2051	0.2706	0.4034
10	0.0678	0.0001	0.0001	0.0001	1.0000	0.8671	0.6635
11	0.2051	0.0001	0.0001	0.0001	0.5695	0.6880	0.8935
12	.	0.0008	0.0004	0.0001	0.0678	0.0964	0.1617
13	0.0008	.	0.8147	0.0001	0.0001	0.0001	0.0001
14	0.0004	0.8147	.	0.0001	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0001	.	0.0001	0.0001	0.0001
16	0.0678	0.0001	0.0001	0.0001	.	0.8671	0.6635

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!

8

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!

08:32 Monday, April 14, 1997

---------- TEST=A ----------

General Linear Models Procedure

Least Squares Means

Least Squares Means for effect TRTMT*MONTH
Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

Dependent Variable: FLORETS

i/j	12	13	14	15	16	17	18
17	0.0964	0.0001	0.0001	0.0001	0.8671	.	0.7888
18	0.1617	0.0001	0.0001	0.0001	0.6635	0.7888	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

LOCN	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
PK	DEC	3.1250000	1.5204276	0.0424	1
PK	OCT	5.2500000	1.5204276	0.0008	2
PK	SEPT	19.1250000	1.5204276	0.0001	3
STW	DEC	5.4583333	1.5204276	0.0005	4
STW	OCT	9.1250000	1.5204276	0.0001	5
STW	SEPT	18.9583333	1.5204276	0.0001	6

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6
1	.	0.3254	0.0001	0.2804	0.0063	0.0001
2	0.3254	.	0.0001	0.9230	0.0745	0.0001
3	0.0001	0.0001	.	0.0001	0.0001	0.9384
4	0.2804	0.9230	0.0001		0.0912	0.0001
5	0.0063	0.0745	0.0001	0.0912	.	0.0001
6	0.0001	0.0001	0.9384	0.0001	0.0001	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
9

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=B ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4

TRTMT 6 5R1 5R4 8R1 8R4 CONT HAM

MONTH 3 DEC OCT SEPT

Number of observations in by group = 144

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL! 10

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=B ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	77178.41666667	1882.40040650	11.46	0.0001
Error	102	16755.47222222	164.26933551		
Corrected Total	143	93933.88888889			

R-Square	C.V.	Root MSE	FLORETS Mean
0.821625	31.28158	12.81675995	40.97222222

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	1056.25000000	1056.25000000	6.43	0.0127
ROW(LOCN)	6	1099.52777778	183.25462963	1.12	0.3586
TRTMT	5	37944.30555556	7588.86111111	46.20	0.0001
LOCN*TRTMT	5	1094.66666667	218.93333333	1.33	0.2564
MONTH	2	10219.84722222	5109.92361111	31.11	0.0001
LOCN*MONTH	2	2727.87500000	1363.93750000	8.30	0.0005
TRTMT*MONTH	10	20388.48611111	2038.84861111	12.41	0.0001
LOCN*TRTMT*MONTH	10	2647.45833333	264.74583333	1.61	0.1137

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	1056.25000000	1056.25000000	5.76	0.0532

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL! 11

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=B ----------

General Linear Models Procedure
Least Squares Means

TRTMT	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
5R1	DEC	28.7500000	4.5314089	0.0001	1
5R1	OCT	69.0000000	4.5314089	0.0001	2
5R1	SEPT	55.6250000	4.5314089	0.0001	3
5R4	DEC	43.1250000	4.5314089	0.0001	4
5R4	OCT	52.3750000	4.5314089	0.0001	5
5R4	SEPT	50.2500000	4.5314089	0.0001	6
8R1	DEC	20.6250000	4.5314089	0.0001	7
8R1	OCT	60.5000000	4.5314089	0.0001	8
8R1	SEPT	47.6250000	4.5314089	0.0001	9
8R4	DEC	30.3750000	4.5314089	0.0001	10
8R4	OCT	62.8750000	4.5314089	0.0001	11
8R4	SEPT	71.5000000	4.5314089	0.0001	12
CONT	DEC	52.6250000	4.5314089	0.0001	13
CONT	OCT	58.8750000	4.5314089	0.0001	14
CONT	SEPT	15.2500000	4.5314089	0.0011	15
HAM	DEC	11.1250000	4.5314089	0.0158	16
HAM	OCT	6.5000000	4.5314089	0.1545	17
HAM	SEPT	0.5000000	4.5314089	0.9124	18

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7	8	9	10	11
1	.	0.0001	0.0001	0.0270	0.0004	0.0011	0.2077	0.0001	0.0040	0.8003	0.0001
2	0.0001	.	0.0394	0.0001	0.0109	0.0042	0.0001	0.1877	0.0012	0.0001	0.3414
3	0.0001	0.0394	.	0.0539	0.6131	0.4036	0.0001	0.4486	0.2148	0.0001	0.2606
4	0.0270	0.0001	0.0539	.	0.1520	0.2688	0.0007	0.0079	0.4842	0.0493	0.0026
5	0.0004	0.0109	0.6131	0.1520	.	0.7409	0.0001	0.2077	0.4603	0.0009	0.1044
6	0.0011	0.0042	0.4036	0.2688	0.7409	.	0.0001	0.1128	0.6829	0.0025	0.0515
7	0.2077	0.0001	0.0001	0.0007	0.0001	0.0001	.	0.0001	0.0001	0.1312	0.0001
8	0.0001	0.1877	0.4486	0.0079	0.2077	0.1128	0.0001	.	0.0472	0.0001	0.7117
9	0.0040	0.0012	0.2148	0.4842	0.4603	0.6829	0.0001	0.0472	.	0.0083	0.0192
10	0.8003	0.0001	0.0001	0.0493	0.0009	0.0025	0.1312	0.0001	0.0083	.	0.0001
11	0.0001	0.3414	0.2606	0.0026	0.1044	0.0515	0.0001	0.7117	0.0192	0.0001	.
12	0.0001	0.6973	0.0149	0.0001	0.0036	0.0013	0.0001	0.0891	0.0003	0.0001	0.1813
13	0.0003	0.0121	0.6407	0.1413	0.9690	0.7117	0.0001	0.2220	0.4371	0.0008	0.1128
14	0.0001	0.1172	0.6131	0.0157	0.3128	0.1813	0.0001	0.8003	0.0822	0.0001	0.5339
15	0.0376	0.0001	0.0001	0.0001	0.0001	0.0001	0.4036	0.0001	0.0001	0.0202	0.0001
16	0.0070	0.0001	0.0001	0.0001	0.0001	0.0001	0.1413	0.0001	0.0001	0.0034	0.0001
17	0.0008	0.0001	0.0001	0.0001	0.0001	0.0001	0.0298	0.0001	0.0001	0.0003	0.0001
18	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0022	0.0001	0.0001	0.0001	0.0001

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	12	13	14	15	16	17	18
1	0.0001	0.0003	0.0001	0.0376	0.0070	0.0008	0.0001
2	0.6973	0.0121	0.1172	0.0001	0.0001	0.0001	0.0001
3	0.0149	0.6407	0.6131	0.0001	0.0001	0.0001	0.0001

4	0.0001	0.1413	0.0157	0.0001	0.0001	0.0001	0.0001
5	0.0036	0.9690	0.3128	0.0001	0.0001	0.0001	0.0001
6	0.0013	0.7117	0.1813	0.0001	0.0001	0.0001	0.0001
7	0.0001	0.0001	0.0001	0.4036	0.1413	0.0298	0.0022
8	0.0891	0.2220	0.8003	0.0001	0.0001	0.0001	0.0001
9	0.0003	0.4371	0.0822	0.0001	0.0001	0.0001	0.0001
10	0.0001	0.0008	0.0001	0.0202	0.0034	0.0003	0.0001
11	0.1813	0.1128	0.5339	0.0001	0.0001	0.0001	0.0001
12	.	0.0040	0.0515	0.0001	0.0001	0.0001	0.0001
13	0.0040	.	0.3317	0.0001	0.0001	0.0001	0.0001
14	0.0515	0.3317	.	0.0001	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0001	.	0.5212	0.1751	0.0234
16	0.0001	0.0001	0.0001	0.5212	.	0.4721	0.1004

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
12

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=B ----------

General Linear Models Procedure
Least Squares Means

Least Squares Means for effect TRTMT*MONTH
Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

Dependent Variable: FLORETS

i/j	12	13	14	15	16	17	18
17	0.0001	0.0001	0.0001	0.1751	0.4721	.	0.3513
18	0.0001	0.0001	0.0001	0.0234	0.1004	0.3513	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

LOCN	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
PK	DEC	26.1666667	2.6162102	0.0001	1
PK	OCT	45.1250000	2.6162102	0.0001	2
PK	SEPT	43.5000000	2.6162102	0.0001	3
STW	DEC	36.0416667	2.6162102	0.0001	4
STW	OCT	58.2500000	2.6162102	0.0001	5
STW	SEPT	36.7500000	2.6162102	0.0001	6

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6
1		0.0001	0.0001	0.0089	0.0001	0.0051
2	0.0001	.	0.6614	0.0158	0.0006	0.0257
3	0.0001	0.6614	.	0.0464	0.0001	0.0710

4	0.0089	0.0158	0.0464	.	0.0001	0.8486
5	0.0001	0.0006	0.0001	0.0001	.	0.0001
6	0.0051	0.0257	0.0710	0.8486	0.0001	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
13

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=C ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4
TRTMT	6	5R1 5R4 8R1 8R4 CONT HAM
MONTH	3	DEC OCT SEPT

Number of observations in by group = 144

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
14

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=C ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	36876.97222222	899.43834688	8.45	0.0001
Error	102	10857.66666667	106.44771242		
Corrected Total	143	47734.63888889			

R-Square	C.V.	Root MSE	FLORETS Mean
0.772541	51.19567	10.31735007	20.15277778

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	66.69444444	66.69444444	0.63	0.4305
ROW(LOCN)	6	624.83333333	104.13888889	0.98	0.4439
TRTMT	5	23384.30555556	4676.86111111	43.94	0.0001
LOCN*TRTMT	5	198.63888889	39.72777778	0.37	0.8660
MONTH	2	4410.18055556	2205.09027778	20.72	0.0001
LOCN*MONTH	2	1206.26388889	603.13194444	5.67	0.0046
TRTMT*MONTH	10	5821.65277778	582.16527778	5.47	0.0001
LOCN*TRTMT*MONTH	10	1164.40277778	116.44027778	1.09	0.3740

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	66.69444444	66.69444444	0.64	0.4541

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!

15

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!

08:32 Monday, April 14, 1997

---------- TEST=C ----------

General Linear Models Procedure

Least Squares Means

TRTMT	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
5R1	DEC	41.7500000	3.6477341	0.0001	1
5R1	OCT	16.7500000	3.6477341	0.0001	2
5R1	SEPT	28.8750000	3.6477341	0.0001	3
5R4	DEC	25.0000000	3.6477341	0.0001	4
5R4	OCT	18.0000000	3.6477341	0.0001	5
5R4	SEPT	16.6250000	3.6477341	0.0001	6
8R1	DEC	40.7500000	3.6477341	0.0001	7
8R1	OCT	20.1250000	3.6477341	0.0001	8
8R1	SEPT	41.7500000	3.6477341	0.0001	9
8R4	DEC	51.0000000	3.6477341	0.0001	10
8R4	OCT	24.2500000	3.6477341	0.0001	11
8R4	SEPT	17.5000000	3.6477341	0.0001	12
CONT	DEC	6.6250000	3.6477341	0.0723	13
CONT	OCT	6.5000000	3.6477341	0.0777	14
CONT	SEPT	6.2500000	3.6477341	0.0897	15
HAM	DEC	0.5000000	3.6477341	0.8912	16
HAM	OCT	0.5000000	3.6477341	0.8912	17
HAM	SEPT	-0.0000000	3.6477341	1.0000	18

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7	8	9	10	11
1	.	0.0001	0.0142	0.0016	0.0001	0.0001	0.8467	0.0001	1.0000	0.0759	0.0010

2	0.0001	.	0.0207	0.1129	0.8090	0.9807	0.0001	0.5144	0.0001	0.0001	0.1491
3	0.0142	0.0207	.	0.4543	0.0375	0.0194	0.0234	0.0929	0.0142	0.0001	0.3721
4	0.0016	0.1129	0.4543	.	0.1778	0.1076	0.0029	0.3469	0.0016	0.0001	0.8847
5	0.0001	0.8090	0.0375	0.1778	.	0.7904	0.0001	0.6813	0.0001	0.0001	0.2285
6	0.0001	0.9807	0.0194	0.1076	0.7904	.	0.0001	0.4990	0.0001	0.0001	0.1425
7	0.8467	0.0001	0.0234	0.0029	0.0001	0.0001	.	0.0001	0.8467	0.0496	0.0018
8	0.0001	0.5144	0.0929	0.3469	0.6813	0.4990	0.0001	.	0.0001	0.0001	0.4258
9	1.0000	0.0001	0.0142	0.0016	0.0001	0.0001	0.8467	0.0001	.	0.0759	0.0010
10	0.0759	0.0001	0.0001	0.0001	0.0001	0.0001	0.0496	0.0001	0.0759	.	0.0001
11	0.0010	0.1491	0.3721	0.8847	0.2285	0.1425	0.0018	0.4258	0.0010	0.0001	.
12	0.0001	0.8847	0.0297	0.1491	0.9230	0.8656	0.0001	0.6120	0.0001	0.0001	0.1937
13	0.0001	0.0524	0.0001	0.0006	0.0297	0.0553	0.0001	0.0102	0.0001	0.0001	0.0009
14	0.0001	0.0496	0.0001	0.0005	0.0280	0.0524	0.0001	0.0096	0.0001	0.0001	0.0008
15	0.0001	0.0444	0.0001	0.0004	0.0248	0.0469	0.0001	0.0084	0.0001	0.0001	0.0007
16	0.0001	0.0021	0.0001	0.0001	0.0010	0.0023	0.0001	0.0002	0.0001	0.0001	0.0001
17	0.0001	0.0021	0.0001	0.0001	0.0010	0.0023	0.0001	0.0002	0.0001	0.0001	0.0001
18	0.0001	0.0016	0.0001	0.0001	0.0007	0.0017	0.0001	0.0002	0.0001	0.0001	0.0001

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	12	13	14	15	16	17	18
1	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
2	0.8847	0.0524	0.0496	0.0444	0.0021	0.0021	0.0016
3	0.0297	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
4	0.1491	0.0006	0.0005	0.0004	0.0001	0.0001	0.0001
5	0.9230	0.0297	0.0280	0.0248	0.0010	0.0010	0.0007
6	0.8656	0.0553	0.0524	0.0469	0.0023	0.0023	0.0017
7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
8	0.6120	0.0102	0.0096	0.0084	0.0002	0.0002	0.0002
9	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
11	0.1937	0.0009	0.0008	0.0007	0.0001	0.0001	0.0001
12	.	0.0375	0.0354	0.0315	0.0014	0.0014	0.0010
13	0.0375	.	0.9807	0.9422	0.2379	0.2379	0.2020
14	0.0354	0.9807	.	0.9614	0.2475	0.2475	0.2105
15	0.0315	0.9422	0.9614	.	0.2676	0.2676	0.2285
16	0.0014	0.2379	0.2475	0.2676	.	1.0000	0.9230

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
16

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=C ----------

General Linear Models Procedure
Least Squares Means

Least Squares Means for effect TRTMT*MONTH
Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

Dependent Variable: FLORETS

i/j	12	13	14	15	16	17	18
17	0.0014	0.2379	0.2475	0.2676	1.0000	.	0.9230
18	0.0010	0.2020	0.2105	0.2285	0.9230	0.9230	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

LOCN	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
PK	DEC	30.7916667	2.1060203	0.0001	1
PK	OCT	16.5833333	2.1060203	0.0001	2
PK	SEPT	15.1250000	2.1060203	0.0001	3
STW	DEC	24.4166667	2.1060203	0.0001	4
STW	OCT	12.1250000	2.1060203	0.0001	5
STW	SEPT	21.8750000	2.1060203	0.0001	6

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6
1	.	0.0001	0.0001	0.0347	0.0001	0.0035
2	0.0001	.	0.6254	0.0099	0.1375	0.0786
3	0.0001	0.6254	.	0.0024	0.3162	0.0255
4	0.0347	0.0099	0.0024	.	0.0001	0.3954
5	0.0001	0.1375	0.3162	0.0001	.	0.0015
6	0.0035	0.0786	0.0255	0.3954	0.0015	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
17

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=D ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4
TRTMT	6	5R1 5R4 8R1 8R4 CONT HAM
MONTH	3	DEC OCT SEPT

Number of observations in by group = 144

---------- TEST=D ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	20608.45138889	502.64515583	3.84	0.0001
Error	102	13355.48611111	130.93613834		
Corrected Total	143	33963.93750000			

R-Square	C.V.	Root MSE	FLORETS Mean
0.606775	91.38955	11.44273299	12.52083333

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	905.00694444	905.00694444	6.91	0.0099
ROW(LOCN)	6	394.76388889	65.79398148	0.50	0.8052
TRTMT	5	5336.64583333	1067.32916667	8.15	0.0001
LOCN*TRTMT	5	663.20138889	132.64027778	1.01	0.4140
MONTH	2	6206.62500000	3103.31250000	23.70	0.0001
LOCN*MONTH	2	1102.34722222	551.17361111	4.21	0.0175
TRTMT*MONTH	10	2599.54166667	259.95416667	1.99	0.0424
LOCN*TRTMT*MONTH	10	3400.31944444	340.03194444	2.60	0.0076

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	905.00694444	905.00694444	13.76	0.0100

---------- TEST=D ----------

General Linear Models Procedure
Least Squares Means

LOCN	TRTMT	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number

PK	5R1	DEC	38.0000000	5.7213665	0.0001	1
PK	5R1	OCT	8.0000000	5.7213665	0.1651	2
PK	5R1	SEPT	7.2500000	5.7213665	0.2080	3
PK	5R4	DEC	35.2500000	5.7213665	0.0001	4
PK	5R4	OCT	28.2500000	5.7213665	0.0001	5
PK	5R4	SEPT	2.2500000	5.7213665	0.6949	6
PK	8R1	DEC	28.7500000	5.7213665	0.0001	7
PK	8R1	OCT	25.0000000	5.7213665	0.0001	8
PK	8R1	SEPT	7.7500000	5.7213665	0.1785	9
PK	8R4	DEC	15.0000000	5.7213665	0.0101	10
PK	8R4	OCT	13.2500000	5.7213665	0.0226	11
PK	8R4	SEPT	3.0000000	5.7213665	0.6012	12
PK	CONT	DEC	22.0000000	5.7213665	0.0002	13
PK	CONT	OCT	26.0000000	5.7213665	0.0001	14
PK	CONT	SEPT	8.2500000	5.7213665	0.1524	15
PK	HAM	DEC	1.2500000	5.7213665	0.8275	16
PK	HAM	OCT	0.0000000	5.7213665	1.0000	17
PK	HAM	SEPT	1.2500000	5.7213665	0.8275	18
STW	5R1	DEC	13.0000000	5.7213665	0.0252	19
STW	5R1	OCT	5.2500000	5.7213665	0.3610	20
STW	5R1	SEPT	3.5000000	5.7213665	0.5421	21
STW	5R4	DEC	16.0000000	5.7213665	0.0062	22
STW	5R4	OCT	7.7500000	5.7213665	0.1785	23
STW	5R4	SEPT	18.0000000	5.7213665	0.0022	24
STW	8R1	DEC	45.5000000	5.7213665	0.0001	25
STW	8R1	OCT	6.0000000	5.7213665	0.2968	26
STW	8R1	SEPT	2.0000000	5.7213665	0.7274	27
STW	8R4	DEC	21.2500000	5.7213665	0.0003	28
STW	8R4	OCT	6.2500000	5.7213665	0.2772	29
STW	8R4	SEPT	5.2500000	5.7213665	0.3610	30
STW	CONT	DEC	20.0000000	5.7213665	0.0007	31
STW	CONT	OCT	2.0000000	5.7213665	0.7274	32
STW	CONT	SEPT	7.5000000	5.7213665	0.1928	33
STW	HAM	DEC	-0.0000000	5.7213665	1.0000	34
STW	HAM	OCT	-0.0000000	5.7213665	1.0000	35
STW	HAM	SEPT	1.0000000	5.7213665	0.8616	36

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7	8	9	10	11
1	.	0.0003	0.0002	0.7347	0.2310	0.0001	0.2556	0.1112	0.0003	0.0054	0.0028
2	0.0003	.	0.9263	0.0011	0.0139	0.4789	0.0118	0.0381	0.9754	0.3890	0.5179
3	0.0002	0.9263	.	0.0008	0.0108	0.5380	0.0091	0.0305	0.9508	0.3404	0.4601
4	0.7347	0.0011	0.0008	.	0.3890	0.0001	0.4236	0.2081	0.0010	0.0139	0.0077
5	0.2310	0.0139	0.0108	0.3890	.	0.0018	0.9508	0.6888	0.0128	0.1046	0.0666
6	0.0001	0.4789	0.5380	0.0001	0.0018	.	0.0014	0.0059	0.4982	0.1182	0.1770
7	0.2556	0.0118	0.0091	0.4236	0.9508	0.0014	.	0.6440	0.0108	0.0923	0.0582
8	0.1112	0.0381	0.0305	0.2081	0.6888	0.0059	0.6440	.	0.0354	0.2193	0.1495
9	0.0003	0.9754	0.9508	0.0010	0.0128	0.4982	0.0108	0.0354	.	0.3723	0.4982
10	0.0054	0.3890	0.3404	0.0139	0.1046	0.1182	0.0923	0.2193	0.3723	.	0.8292
11	0.0028	0.5179	0.4601	0.0077	0.0666	0.1770	0.0582	0.1495	0.4982	0.8292	.
12	0.0001	0.5380	0.6005	0.0001	0.0023	0.9263	0.0019	0.0077	0.5585	0.1411	0.2081
13	0.0507	0.0866	0.0712	0.1046	0.4416	0.0164	0.4061	0.7116	0.0812	0.3890	0.2821
14	0.1411	0.0283	0.0225	0.2556	0.7815	0.0041	0.7347	0.9019	0.0262	0.1770	0.1182
15	0.0004	0.9754	0.9019	0.0012	0.0151	0.4601	0.0128	0.0410	0.9508	0.4061	0.5380

16	0.0001	0.4061	0.4601	0.0001	0.0012	0.9019	0.0010	0.0041	0.4236	0.0923	0.1411
17	0.0001	0.3251	0.3723	0.0001	0.0007	0.7815	0.0006	0.0026	0.3404	0.0666	0.1046
18	0.0001	0.4061	0.4601	0.0001	0.0012	0.9019	0.0010	0.0041	0.4236	0.0923	0.1411
19	0.0026	0.5380	0.4789	0.0071	0.0623	0.1869	0.0543	0.1411	0.5179	0.8053	0.9754
20	0.0001	0.7347	0.8053	0.0003	0.0054	0.7116	0.0045	0.0164	0.7580	0.2310	0.3251

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
20

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=D ----------

General Linear Models Procedure
Least Squares Means

Least Squares Means for effect LOCN*TRTMT*MONTH
Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

Dependent Variable: FLORETS

i/j	1	2	3	4	5	6	7	8	9	10	11
21	0.0001	0.5793	0.6440	0.0002	0.0028	0.8775	0.0023	0.0091	0.6005	0.1583	0.2310
22	0.0077	0.3251	0.2821	0.0192	0.1331	0.0923	0.1182	0.2686	0.3103	0.9019	0.7347
23	0.0003	0.9754	0.9508	0.0010	0.0128	0.4982	0.0108	0.0354	1.0000	0.3723	0.4982
24	0.0151	0.2193	0.1869	0.0354	0.2081	0.0543	0.1869	0.3890	0.2081	0.7116	0.5585
25	0.3562	0.0001	0.0001	0.2081	0.0354	0.0001	0.0410	0.0128	0.0001	0.0003	0.0001
26	0.0001	0.8053	0.8775	0.0005	0.0071	0.6440	0.0059	0.0208	0.8292	0.2686	0.3723
27	0.0001	0.4601	0.5179	0.0001	0.0016	0.9754	0.0013	0.0054	0.4789	0.1112	0.1674
28	0.0410	0.1046	0.0866	0.0866	0.3890	0.0208	0.3562	0.6440	0.0983	0.4416	0.3251
29	0.0002	0.8292	0.9019	0.0005	0.0077	0.6221	0.0065	0.0225	0.8533	0.2821	0.3890
30	0.0001	0.7347	0.8053	0.0003	0.0054	0.7116	0.0045	0.0164	0.7580	0.2310	0.3251
31	0.0283	0.1411	0.1182	0.0623	0.3103	0.0305	0.2821	0.5380	0.1331	0.5380	0.4061
32	0.0001	0.4601	0.5179	0.0001	0.0016	0.9754	0.0013	0.0054	0.4789	0.1112	0.1674
33	0.0003	0.9508	0.9754	0.0009	0.0118	0.5179	0.0100	0.0329	0.9754	0.3562	0.4789
34	0.0001	0.3251	0.3723	0.0001	0.0007	0.7815	0.0006	0.0026	0.3404	0.0666	0.1046
35	0.0001	0.3251	0.3723	0.0001	0.0007	0.7815	0.0006	0.0026	0.3404	0.0666	0.1046
36	0.0001	0.3890	0.4416	0.0001	0.0011	0.8775	0.0009	0.0038	0.4061	0.0866	0.1331

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	12	13	14	15	16	17	18	19	20	21	22
1	0.0001	0.0507	0.1411	0.0004	0.0001	0.0001	0.0001	0.0026	0.0001	0.0001	0.0077
2	0.5380	0.0866	0.0283	0.9754	0.4061	0.3251	0.4061	0.5380	0.7347	0.5793	0.3251
3	0.6005	0.0712	0.0225	0.9019	0.4601	0.3723	0.4601	0.4789	0.8053	0.6440	0.2821
4	0.0001	0.1046	0.2556	0.0012	0.0001	0.0001	0.0001	0.0071	0.0003	0.0002	0.0192
5	0.0023	0.4416	0.7815	0.0151	0.0012	0.0007	0.0012	0.0623	0.0054	0.0028	0.1331
6	0.9263	0.0164	0.0041	0.4601	0.9019	0.7815	0.9019	0.1869	0.7116	0.8775	0.0923
7	0.0019	0.4061	0.7347	0.0128	0.0010	0.0006	0.0010	0.0543	0.0045	0.0023	0.1182
8	0.0077	0.7116	0.9019	0.0410	0.0041	0.0026	0.0041	0.1411	0.0164	0.0091	0.2686
9	0.5585	0.0812	0.0262	0.9508	0.4236	0.3404	0.4236	0.5179	0.7580	0.6005	0.3103
10	0.1411	0.3890	0.1770	0.4061	0.0923	0.0666	0.0923	0.8053	0.2310	0.1583	0.9019
11	0.2081	0.2821	0.1182	0.5380	0.1411	0.1046	0.1411	0.9754	0.3251	0.2310	0.7347
12	.	0.0208	0.0054	0.5179	0.8292	0.7116	0.8292	0.2193	0.7815	0.9508	0.1112
13	0.0208	.	0.6221	0.0923	0.0118	0.0077	0.0118	0.2686	0.0410	0.0243	0.4601
14	0.0054	0.6221		0.0305	0.0028	0.0018	0.0028	0.1112	0.0118	0.0065	0.2193

15	0.5179	0.0923	0.0305	.	0.3890	0.3103	0.3890	0.5585	0.7116	0.5585	0.3404
16	0.8292	0.0118	0.0028	0.3890	.	0.8775	1.0000	0.1495	0.6221	0.7815	0.0712
17	0.7116	0.0077	0.0018	0.3103	0.8775	.	0.8775	0.1112	0.5179	0.6662	0.0507
18	0.8292	0.0118	0.0028	0.3890	1.0000	0.8775	.	0.1495	0.6221	0.7815	0.0712
19	0.2193	0.2686	0.1112	0.5585	0.1495	0.1112	0.1495	.	0.3404	0.2431	0.7116
20	0.7815	0.0410	0.0118	0.7116	0.6221	0.5179	0.6221	0.3404	.	0.8292	0.1869
21	0.9508	0.0243	0.0065	0.5585	0.7815	0.6662	0.7815	0.2431	0.8292	.	0.1255
22	0.1112	0.4601	0.2193	0.3404	0.0712	0.0507	0.0712	0.7116	0.1869	0.1255	.
23	0.5585	0.0812	0.0262	0.9508	0.4236	0.3404	0.4236	0.5179	0.7580	0.6005	0.3103
24	0.0666	0.6221	0.3251	0.2310	0.0410	0.0283	0.0410	0.5380	0.1182	0.0761	0.8053
25	0.0001	0.0045	0.0177	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0004
26	0.7116	0.0507	0.0151	0.7815	0.5585	0.4601	0.5585	0.3890	0.9263	0.7580	0.2193
27	0.9019	0.0151	0.0038	0.4416	0.9263	0.8053	0.9263	0.1770	0.6888	0.8533	0.0866
28	0.0262	0.9263	0.5585	0.1112	0.0151	0.0100	0.0151	0.3103	0.0507	0.0305	0.5179
29	0.6888	0.0543	0.0164	0.8053	0.5380	0.4416	0.5380	0.4061	0.9019	0.7347	0.2310
30	0.7815	0.0410	0.0118	0.7116	0.6221	0.5179	0.6221	0.3404	1.0000	0.8292	0.1869
31	0.0381	0.8053	0.4601	0.1495	0.0225	0.0151	0.0225	0.3890	0.0712	0.0440	0.6221
32	0.9019	0.0151	0.0038	0.4416	0.9263	0.8053	0.9263	0.1770	0.6888	0.8533	0.0866
33	0.5793	0.0761	0.0243	0.9263	0.4416	0.3562	0.4416	0.4982	0.7815	0.6221	0.2960
34	0.7116	0.0077	0.0018	0.3103	0.8775	1.0000	0.8775	0.1112	0.5179	0.6662	0.0507
35	0.7116	0.0077	0.0018	0.3103	0.8775	1.0000	0.8775	0.1112	0.5179	0.6662	0.0507
36	0.8053	0.0108	0.0026	0.3723	0.9754	0.9019	0.9754	0.1411	0.6005	0.7580	0.0666

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
21

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=D ----------

General Linear Models Procedure
Least Squares Means

Least Squares Means for effect LOCN*TRTMT*MONTH
Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

Dependent Variable: FLORETS

i/j	23	24	25	26	27	28	29	30	31	32	33
1	0.0003	0.0151	0.3562	0.0001	0.0001	0.0410	0.0002	0.0001	0.0283	0.0001	0.0003
2	0.9754	0.2193	0.0001	0.8053	0.4601	0.1046	0.8292	0.7347	0.1411	0.4601	0.9508
3	0.9508	0.1869	0.0001	0.8775	0.5179	0.0866	0.9019	0.8053	0.1182	0.5179	0.9754
4	0.0010	0.0354	0.2081	0.0005	0.0001	0.0866	0.0005	0.0003	0.0623	0.0001	0.0009
5	0.0128	0.2081	0.0354	0.0071	0.0016	0.3890	0.0077	0.0054	0.3103	0.0016	0.0118
6	0.4982	0.0543	0.0001	0.6440	0.9754	0.0208	0.6221	0.7116	0.0305	0.9754	0.5179
7	0.0108	0.1869	0.0410	0.0059	0.0013	0.3562	0.0065	0.0045	0.2821	0.0013	0.0100
8	0.0354	0.3890	0.0128	0.0208	0.0054	0.6440	0.0225	0.0164	0.5380	0.0054	0.0329
9	1.0000	0.2081	0.0001	0.8292	0.4789	0.0983	0.8533	0.7580	0.1331	0.4789	0.9754
10	0.3723	0.7116	0.0003	0.2686	0.1112	0.4416	0.2821	0.2310	0.5380	0.1112	0.3562
11	0.4982	0.5585	0.0001	0.3723	0.1674	0.3251	0.3890	0.3251	0.4061	0.1674	0.4789
12	0.5585	0.0666	0.0001	0.7116	0.9019	0.0262	0.6888	0.7815	0.0381	0.9019	0.5793
13	0.0812	0.6221	0.0045	0.0507	0.0151	0.9263	0.0543	0.0410	0.8053	0.0151	0.0761
14	0.0262	0.3251	0.0177	0.0151	0.0038	0.5585	0.0164	0.0118	0.4601	0.0038	0.0243
15	0.9508	0.2310	0.0001	0.7815	0.4416	0.1112	0.8053	0.7116	0.1495	0.4416	0.9263
16	0.4236	0.0410	0.0001	0.5585	0.9263	0.0151	0.5380	0.6221	0.0225	0.9263	0.4416
17	0.3404	0.0283	0.0001	0.4601	0.8053	0.0100	0.4416	0.5179	0.0151	0.8053	0.3562

18	0.4236	0.0410	0.0001	0.5585	0.9263	0.0151	0.5380	0.6221	0.0225	0.9263	0.4416
19	0.5179	0.5380	0.0001	0.3890	0.1770	0.3103	0.4061	0.3404	0.3890	0.1770	0.4982
20	0.7580	0.1182	0.0001	0.9263	0.6888	0.0507	0.9019	1.0000	0.0712	0.6888	0.7815
21	0.6005	0.0761	0.0001	0.7580	0.8533	0.0305	0.7347	0.8292	0.0440	0.8533	0.6221
22	0.3103	0.8053	0.0004	0.2193	0.0866	0.5179	0.2310	0.1869	0.6221	0.0866	0.2960
23	.	0.2081	0.0001	0.8292	0.4789	0.0983	0.8533	0.7580	0.1331	0.4789	0.9754
24	0.2081	.	0.0010	0.1411	0.0507	0.6888	0.1495	0.1182	0.8053	0.0507	0.1973
25	0.0001	0.0010	.	0.0001	0.0001	0.0034	0.0001	0.0001	0.0021	0.0001	0.0001
26	0.8292	0.1411	0.0001	.	0.6221	0.0623	0.9754	0.9263	0.0866	0.6221	0.8533
27	0.4789	0.0507	0.0001	0.6221	.	0.0192	0.6005	0.6888	0.0283	1.0000	0.4982
28	0.0983	0.6888	0.0034	0.0623	0.0192	.	0.0666	0.0507	0.8775	0.0192	0.0923
29	0.8533	0.1495	0.0001	0.9754	0.6005	0.0666	.	0.9019	0.0923	0.6005	0.8775
30	0.7580	0.1182	0.0001	0.9263	0.6888	0.0507	0.9019	.	0.0712	0.6888	0.7815
31	0.1331	0.8053	0.0021	0.0866	0.0283	0.8775	0.0923	0.0712	.	0.0283	0.1255
32	0.4789	0.0507	0.0001	0.6221	1.0000	0.0192	0.6005	0.6888	0.0283	.	0.4982
33	0.9754	0.1973	0.0001	0.8533	0.4982	0.0923	0.8775	0.7815	0.1255	0.4982	.
34	0.3404	0.0283	0.0001	0.4601	0.8053	0.0100	0.4416	0.5179	0.0151	0.8053	0.3562
35	0.3404	0.0283	0.0001	0.4601	0.8053	0.0100	0.4416	0.5179	0.0151	0.8053	0.3562
36	0.4061	0.0381	0.0001	0.5380	0.9019	0.0139	0.5179	0.6005	0.0208	0.9019	0.4236

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	34	35	36
1	0.0001	0.0001	0.0001
2	0.3251	0.3251	0.3890
3	0.3723	0.3723	0.4416
4	0.0001	0.0001	0.0001
5	0.0007	0.0007	0.0011
6	0.7815	0.7815	0.8775
7	0.0006	0.0006	0.0009
8	0.0026	0.0026	0.0038
9	0.3404	0.3404	0.4061
10	0.0666	0.0666	0.0866
11	0.1046	0.1046	0.1331
12	0.7116	0.7116	0.8053
13	0.0077	0.0077	0.0108
14	0.0018	0.0018	0.0026
15	0.3103	0.3103	0.3723
16	0.8775	0.8775	0.9754
17	1.0000	1.0000	0.9019

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!

22

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!

08:32 Monday, April 14, 1997

---------- TEST=D ----------

General Linear Models Procedure

Least Squares Means

Least Squares Means for effect LOCN*TRTMT*MONTH

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

Dependent Variable: FLORETS

i/j	34	35	36
18	0.8775	0.8775	0.9754
19	0.1112	0.1112	0.1411
20	0.5179	0.5179	0.6005
21	0.6662	0.6662	0.7580
22	0.0507	0.0507	0.0666
23	0.3404	0.3404	0.4061
24	0.0283	0.0283	0.0381
25	0.0001	0.0001	0.0001
26	0.4601	0.4601	0.5380
27	0.8053	0.8053	0.9019
28	0.0100	0.0100	0.0139
29	0.4416	0.4416	0.5179
30	0.5179	0.5179	0.6005
31	0.0151	0.0151	0.0208
32	0.8053	0.8053	0.9019
33	0.3562	0.3562	0.4236
34	.	1.0000	0.9019
35	1.0000	.	0.9019
36	0.9019	0.9019	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
23

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=E ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4
TRTMT	6	5R1 5R4 8R1 8R4 CONT HAM
MONTH	3	DEC OCT SEPT

Number of observations in by group = 144

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
24

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=E ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	486.72916667	11.87144309	3.02	0.0001
Error	102	400.59722222	3.92742375		
Corrected Total	143	887.32638889			

R-Square	C.V.	Root MSE	FLORETS Mean
0.548535	277.0634	1.98177288	0.71527778

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	0.34027778	0.34027778	0.09	0.7691
ROW(LOCN)	6	13.15277778	2.19212963	0.56	0.7626
TRTMT	5	144.86805556	28.97361111	7.38	0.0001
LOCN*TRTMT	5	4.20138889	0.84027778	0.21	0.9559
MONTH	2	42.68055556	21.34027778	5.43	0.0057
LOCN*MONTH	2	5.01388889	2.50694444	0.64	0.5303
TRTMT*MONTH	10	240.40277778	24.04027778	6.12	0.0001
LOCN*TRTMT*MONTH	10	36.06944444	3.60694444	0.92	0.5195

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	0.34027778	0.34027778	0.16	0.7072

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!

25

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!

08:32 Monday, April 14, 1997

---------- TEST=E ----------

General Linear Models Procedure

Level of LOCN	Level of TRTMT	Level of MONTH	N	FLORETS Mean	FLORETS SD
PK	5R1	DEC	4	0.00000000	0.00000000
PK	5R1	OCT	4	1.00000000	2.00000000
PK	5R1	SEPT	4	0.00000000	0.00000000
PK	5R4	DEC	4	0.00000000	0.00000000
PK	5R4	OCT	4	1.00000000	2.00000000
PK	5R4	SEPT	4	0.00000000	0.00000000
PK	8R1	DEC	4	1.00000000	2.00000000

PK	8R1	OCT	4	0.00000000	0.00000000
PK	8R1	SEPT	4	1.00000000	2.00000000
PK	8R4	DEC	4	0.00000000	0.00000000
PK	8R4	OCT	4	0.00000000	0.00000000
PK	8R4	SEPT	4	0.00000000	0.00000000
PK	CONT	DEC	4	0.00000000	0.00000000
PK	CONT	OCT	4	0.00000000	0.00000000
PK	CONT	SEPT	4	0.00000000	0.00000000
PK	HAM	DEC	4	1.00000000	2.00000000
PK	HAM	OCT	4	1.00000000	2.00000000
PK	HAM	SEPT	4	6.00000000	4.54606057
STW	5R1	DEC	4	0.00000000	0.00000000
STW	5R1	OCT	4	0.00000000	0.00000000
STW	5R1	SEPT	4	0.00000000	0.00000000
STW	5R4	DEC	4	1.00000000	2.00000000
STW	5R4	OCT	4	0.00000000	0.00000000
STW	5R4	SEPT	4	1.25000000	2.50000000
STW	8R1	DEC	4	0.00000000	0.00000000
STW	8R1	OCT	4	1.00000000	2.00000000
STW	8R1	SEPT	4	0.00000000	0.00000000
STW	8R4	DEC	4	0.00000000	0.00000000
STW	8R4	OCT	4	1.00000000	2.00000000
STW	8R4	SEPT	4	0.00000000	0.00000000
STW	CONT	DEC	4	0.00000000	0.00000000
STW	CONT	OCT	4	0.00000000	0.00000000
STW	CONT	SEPT	4	0.00000000	0.00000000
STW	HAM	DEC	4	0.00000000	0.00000000
STW	HAM	OCT	4	0.00000000	0.00000000
STW	HAM	SEPT	4	9.50000000	8.66025404

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=F ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4
TRTMT	6	5R1 5R4 8R1 8R4 CONT HAM
MONTH	3	DEC OCT SEPT

Number of observations in by group = 144

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=F ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	106772.34027778	2604.20342141	65.38	0.0001
Error	102	4062.81944444	39.83156318		
Corrected Total	143	110835.15972222			

R-Square	C.V.	Root MSE	FLORETS Mean
0.963344	51.72547	6.31122517	12.20138889

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	4.34027778	4.34027778	0.11	0.7420
ROW(LOCN)	6	177.43055556	29.57175926	0.74	0.6167
TRTMT	5	99301.20138889	19860.24027778	498.61	0.0001
LOCN*TRTMT	5	6.53472222	1.30694444	0.03	0.9994
MONTH	2	850.09722222	425.04861111	10.67	0.0001
LOCN*MONTH	2	319.26388889	159.63194444	4.01	0.0211
TRTMT*MONTH	10	4749.98611111	474.99861111	11.93	0.0001
LOCN*TRTMT*MONTH	10	1363.48611111	136.34861111	3.42	0.0007

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	4.34027778	4.34027778	0.15	0.7148

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
28

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=F ----------

General Linear Models Procedure

Level of LOCN	Level of TRTMT	Level of MONTH	N	FLORETS Mean	FLORETS SD
PK	5R1	DEC	4	2.0000000	2.3094011
PK	5R1	OCT	4	0.0000000	0.0000000

PK	5R1	SEPT	4	0.0000000	0.0000000
PK	5R4	DEC	4	1.0000000	2.0000000
PK	5R4	OCT	4	0.0000000	0.0000000
PK	5R4	SEPT	4	1.7500000	3.5000000
PK	8R1	DEC	4	1.0000000	2.0000000
PK	8R1	OCT	4	1.0000000	2.0000000
PK	8R1	SEPT	4	1.0000000	2.0000000
PK	8R4	DEC	4	0.0000000	0.0000000
PK	8R4	OCT	4	1.0000000	2.0000000
PK	8R4	SEPT	4	0.0000000	0.0000000
PK	CONT	DEC	4	0.0000000	0.0000000
PK	CONT	OCT	4	0.0000000	0.0000000
PK	CONT	SEPT	4	0.0000000	0.0000000
PK	HAM	DEC	4	59.7500000	13.8172597
PK	HAM	OCT	4	65.2500000	13.6473441
PK	HAM	SEPT	4	89.0000000	9.8657657
STW	5R1	DEC	4	1.2500000	2.5000000
STW	5R1	OCT	4	1.0000000	2.0000000
STW	5R1	SEPT	4	0.0000000	0.0000000
STW	5R4	DEC	4	1.0000000	2.0000000
STW	5R4	OCT	4	1.7500000	3.5000000
STW	5R4	SEPT	4	0.0000000	0.0000000
STW	8R1	DEC	4	0.0000000	0.0000000
STW	8R1	OCT	4	0.0000000	0.0000000
STW	8R1	SEPT	4	0.0000000	0.0000000
STW	8R4	DEC	4	0.0000000	0.0000000
STW	8R4	OCT	4	0.0000000	0.0000000
STW	8R4	SEPT	4	0.0000000	0.0000000
STW	CONT	DEC	4	0.0000000	0.0000000
STW	CONT	OCT	4	0.0000000	0.0000000
STW	CONT	SEPT	4	0.0000000	0.0000000
STW	HAM	DEC	4	40.7500000	25.9406374
STW	HAM	OCT	4	86.5000000	8.1853528
STW	HAM	SEPT	4	84.2500000	11.6153634

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!

29

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!

08:32 Monday, April 14, 1997

---------- TEST=G ----------

General Linear Models Procedure

Class Level Information

Class	Levels	Values
LOCN	2	PK STW
ROW	4	1 2 3 4
TRTMT	6	5R1 5R4 8R1 8R4 CONT HAM
MONTH	3	DEC OCT SEPT

Number of observations in by group = 144

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
30

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=G ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	41	13093.33333333	319.34959350	7.80	0.0001
Error	102	4175.22222222	40.93355120		
Corrected Total	143	17268.55555556			

R-Square	C.V.	Root MSE	FLORETS Mean
0.758218	200.2831	6.39793335	3.19444444

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	16.00000000	16.00000000	0.39	0.5332
ROW(LOCN)	6	176.77777778	29.46296296	0.72	0.6346
TRTMT	5	6710.63888889	1342.12777778	32.79	0.0001
LOCN*TRTMT	5	79.08333333	15.81666667	0.39	0.8571
MONTH	2	920.43055556	460.21527778	11.24	0.0001
LOCN*MONTH	2	202.54166667	101.27083333	2.47	0.0893
TRTMT*MONTH	10	3953.73611111	395.37361111	9.66	0.0001
LOCN*TRTMT*MONTH	10	1034.12500000	103.41250000	2.53	0.0093

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	16.00000000	16.00000000	0.54	0.4890

ANALYSIS OF REONNA'S TEST DATA WITH TRTMT*MONTH AS A FACTORIAL!
31

ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'!
08:32 Monday, April 14, 1997

---------- TEST=G ----------

General Linear Models Procedure

Level of LOCN	Level of TRTMT	Level of MONTH	FLORETS N	FLORETS Mean	FLORETS SD
PK	5R1	DEC	4	1.2500000	2.5000000
PK	5R1	OCT	4	0.0000000	0.0000000
PK	5R1	SEPT	4	0.0000000	0.0000000
PK	5R4	DEC	4	1.0000000	2.0000000
PK	5R4	OCT	4	0.0000000	0.0000000
PK	5R4	SEPT	4	0.0000000	0.0000000
PK	8R1	DEC	4	0.0000000	0.0000000
PK	8R1	OCT	4	0.0000000	0.0000000
PK	8R1	SEPT	4	0.0000000	0.0000000
PK	8R4	DEC	4	0.0000000	0.0000000
PK	8R4	OCT	4	0.0000000	0.0000000
PK	8R4	SEPT	4	0.0000000	0.0000000
PK	CONT	DEC	4	0.0000000	0.0000000
PK	CONT	OCT	4	0.0000000	0.0000000
PK	CONT	SEPT	4	0.0000000	0.0000000
PK	HAM	DEC	4	31.2500000	15.3487242
PK	HAM	OCT	4	27.5000000	13.4783777
PK	HAM	SEPT	4	2.5000000	2.8867513
STW	5R1	DEC	4	0.0000000	0.0000000
STW	5R1	OCT	4	0.0000000	0.0000000
STW	5R1	SEPT	4	0.0000000	0.0000000
STW	5R4	DEC	4	0.0000000	0.0000000
STW	5R4	OCT	4	0.0000000	0.0000000
STW	5R4	SEPT	4	0.0000000	0.0000000
STW	8R1	DEC	4	1.0000000	2.0000000
STW	8R1	OCT	4	0.0000000	0.0000000
STW	8R1	SEPT	4	0.0000000	0.0000000
STW	8R4	DEC	4	1.0000000	2.0000000
STW	8R4	OCT	4	0.0000000	0.0000000
STW	8R4	SEPT	4	0.0000000	0.0000000
STW	CONT	DEC	4	0.0000000	0.0000000
STW	CONT	OCT	4	0.0000000	0.0000000
STW	CONT	SEPT	4	0.0000000	0.0000000
STW	HAM	DEC	4	42.7500000	31.1809237
STW	HAM	OCT	4	4.5000000	5.2599113
STW	HAM	SEPT	4	2.2500000	2.6299556

APPENDIX B: ANALYSES OF VARIANCE OF HAMMER MILL DATA

ANALYSIS OF REONNA'S TEST DATA. ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'! 22:26 Thursday, February 27, 1997 1

---------- TEST=E TRTMT=HAM ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
MONTH	3	DEC OCT SEPT
ROW	4	1 2 3 4

Number of observations in by group = 24

ANALYSIS OF REONNA'S TEST DATA. ERROR(A) = ROW(LOCN) & ERROR(B) = 'ERROR'! 22:26 Thursday, February 27, 1997 2

---------- TEST=E TRTMT=HAM ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	404.50000000	36.77272727	2.05	0.1167
Error	12	215.33333333	17.94444444		
Corrected Total	23	619.83333333			

R-Square	C V	Root MSE	FLORETS Mean
0.652595	145.2373	4.23608834	2.91666667

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	1.50000000	1.50000000	0.08	0.7774
ROW(LOCN)	6	95.66666667	15.94444444	0.89	0.5325
MONTH	2	280.33333333	140.16666667	7.81	0.0067
LOCN*MONTH	2	27.00000000	13.50000000	0.75	0.4923

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F

LOCN	1	1.50000000	1.50000000	0.09	0.7694

---------- TEST=E TRTMT=HAM ----------

General Linear Models Procedure
Least Squares Means

MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	Pr > |T| H0: LSMEAN(i)=LSMEAN(j) i/j	1	2	3
DEC	0.50000000	1.49768340	0.7443	1	.	1.0000	0.0051
OCT	0.50000000	1.49768340	0.7443	2	1.0000	.	0.0051
SEPT	7.75000000	1.49768340	0.0002	3	0.0051	0.0051	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

LOCN	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
PK	DEC	1.00000000	2.11804417	0.6453	1
PK	OCT	1.00000000	2.11804417	0.6453	2
PK	SEPT	6.00000000	2.11804417	0.0151	3
STW	DEC	0.00000000	2.11804417	1.0000	4
STW	OCT	0.00000000	2.11804417	1.0000	5
STW	SEPT	9.50000000	2.11804417	0.0007	6

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6
1	.	1.0000	0.1209	0.7443	0.7443	0.0150
2	1.0000	.	0.1209	0.7443	0.7443	0.0150
3	0.1209	0.1209	.	0.0683	0.0683	0.2653
4	0.7443	0.7443	0.0683	.	1.0000	0.0080
5	0.7443	0.7443	0.0683	1.0000	.	0.0080
6	0.0150	0.0150	0.2653	0.0080	0.0080	.

NOTE. To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

---------- TEST=F TRTMT=HAM ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW
MONTH	3	DEC OCT SEPT
ROW	4	1 2 3 4

Number of observations in by group = 24

---------- TEST=F TRTMT=HAM ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	8040.16666667	730.92424242	2.69	0.0519
Error	12	3265.66666667	272.13888889		
Corrected Total	23	11305.83333333			

R-Square	C.V.	Root MSE	FLORETS Mean
0.711152	23.26200	16.49663265	70.91666667

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	4.16666667	4.16666667	0.02	0.9036
ROW(LOCN)	6	782.33333333	130.38888889	0.48	0.8116
MONTH	2	5587.58333333	2793.79166667	10.27	0.0025
LOCN*MONTH	2	1666.08333333	833.04166667	3.06	0.0843

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	4.16666667	4.16666667	0.03	0.8640

---------- TEST=F TRTMT=HAM ----------

General Linear Models Procedure
Least Squares Means

MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	Pr > |T| H0: LSMEAN(i)=LSMEAN(j) i/j	1	2	3
DEC	50.2500000	5.8324404	0.0001	1	.	0.0091	0.0009
OCT	75.8750000	5.8324404	0.0001	2	0.0091	.	0.2169
SEPT	86.6250000	5.8324404	0.0001	3	0.0009	0.2169	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

LOCN	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
PK	DEC	59.7500000	8.2483163	0.0001	1
PK	OCT	65.2500000	8.2483163	0.0001	2
PK	SEPT	89.0000000	8.2483163	0.0001	3
STW	DEC	40.7500000	8.2483163	0.0003	4
STW	OCT	86.5000000	8.2483163	0.0001	5
STW	SEPT	84.2500000	8.2483163	0.0001	6

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6
1	.	0.6457	0.0275	0.1293	0.0407	0.0575
2	0.6457	.	0.0644	0.0575	0.0935	0.1293
3	0.0275	0.0644	.	0.0014	0.8339	0.6910
4	0.1293	0.0575	0.0014	.	0.0020	0.0029
5	0.0407	0.0935	0.8339	0.0020	.	0.8503
6	0.0575	0.1293	0.6910	0.0029	0.8503	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

---------- TEST=G TRTMT=HAM ----------

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LOCN	2	PK STW

MONTH 3 DEC OCT SEPT

ROW 4 1 2 3 4

Number of observations in by group = 24

---------- TEST=G TRTMT=HAM ----------

General Linear Models Procedure

Dependent Variable: FLORETS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	7240.62500000	658.23863636	2.43	0.0710
Error	12	3247.33333333	270.61111111		
Corrected Total	23	10487.95833333			

R-Square	C.V.	Root MSE	FLORETS Mean
0.690375	89.12106	16.45026173	18.45833333

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	92.04166667	92.04166667	0.34	0.5706
ROW(LOCN)	6	1049.91666667	174.98611111	0.65	0.6926
MONTH	2	4868.08333333	2434.04166667	8.99	0.0041
LOCN*MONTH	2	1230.58333333	615.29166667	2.27	0.1454

Tests of Hypotheses using the Type III MS for ROW(LOCN) as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
LOCN	1	92.04166667	92.04166667	0.53	0.4956

---------- TEST=G TRTMT=HAM ----------

General Linear Models Procedure
Least Squares Means

MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	Pr > |T| H0: LSMEAN(i)=LSMEAN(j) i/j	1	2	3

DEC	37.0000000	5.8160458	0.0001	1	.	0.0253	0.0012
OCT	16.0000000	5.8160458	0.0176	2	0.0253	.	0.1235
SEPT	2.3750000	5.8160458	0.6902	3	0.0012	0.1235	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

LOCN	MONTH	FLORETS LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	LSMEAN Number
PK	DEC	31.2500000	8.2251309	0.0025	1
PK	OCT	27.5000000	8.2251309	0.0059	2
PK	SEPT	2.5000000	8.2251309	0.7664	3
STW	DEC	42.7500000	8.2251309	0.0002	4
STW	OCT	4.5000000	8.2251309	0.5943	5
STW	SEPT	2.2500000	8.2251309	0.7891	6

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6
1	.	0.7527	0.0294	0.3424	0.0402	0.0283
2	0.7527	.	0.0527	0.2144	0.0714	0.0507
3	0.0294	0.0527	.	0.0047	0.8664	0.9832
4	0.3424	0.2144	0.0047	.	0.0065	0.0045
5	0.0402	0.0714	0.8664	0.0065	.	0.8499
6	0.0283	0.0507	0.9832	0.0045	0.8499	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

VITA

Reonna Richele Slagell Gossen

Candidate for the Degree of

Master of Science

Thesis: ANATOMICAL EFFECTS OF MECHANICAL DAMAGE ON CARYOPSES OF CHEAT (*BROMUS SECALINUS*)

Major Field: Natural and Applied Sciences

Biographical:

Personal Data: Born in Weatherford, Oklahoma, on September 12, 1965, the daughter of Harold and Ella Slagell; married to Bryan Gossen on March 2, 1996

Education: Graduated from Weatherford High School, Weatherford, Oklahoma in May, 1983; received Bachelor of Science degree in Biological Science from Oklahoma State University Stillwater, Oklahoma in May 1989 and received an Oklahoma Teaching Certificate in Fall 1989. Completed the requirements for the Master of Science degree in Natural and Applied Sciences at Oklahoma State University in May, 1997.

Experience: Raised on a farm near Weatherford, Oklahoma; employed as a farm laborer during summers; taught piano during high school and first years of college while employed as a veterinary assistant at Redland Veterinary Clinic; worked at Sears, Roebuck & Co. as a commissioned sales representative for home improvement and appliances while attending Oklahoma State University; after graduation, was a science instructor for 7-12 grade at Corn Bible Academy in Corn, Oklahoma from 1989-1994; employed by Oklahoma State University as graduate teaching assistant from 1994-1996; currently employed by American Sunmelon as an assistant plant pathologist.

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