

In one part of a larger study an investigator raised 64 pigs in the manner described below. The design is modified from the original, but is consistent with the table presented. There were 32 pens available that were randomly assigned to one of the two sexes and one of two dietary supplements. The diet supplements were either no Chromium picolinate (CrP) added or 200 ppb CrP added to a standard corn-soybean meal diet. Note that there were four combinations of sex and diet (male at 0 ppb CrP, female at 0 ppb CrP, male at 200 ppb CrP, female at 200 ppb CrP). For each combination of sex and diet there were eight pens and two pigs randomly assigned to each pen.

At the end of the experiment the final weight was recorded for each pen and daily weight gain calculated as a single value for each of the 32 pens [(final pen weight – initial pen weight) / days]. At the end of the experiment the variable of interest was the mean weight gain for each treatment.



Table 4. Least squares means of chromium picolinate $\times$ sex effects on growth performance in pigs.

Variables & Treatments	Treatments				SEM	P-Value
Supplement →	0 ppb CrP		200 ppb CrP			
Sex →	Barrows	Gilts	Barrows	Gilts		
Final wt, kg ^b	111.8	103.9	110.6	102.9	1.0	0.90
Daily gain, g/day	895.5	810.4	884.0	802.0	11.4	0.90
Feed intake, g/day	2749.7	2460.6	2748.1	2421.8	33.5	0.59
Gain/Feed	0.33	0.33	0.32	0.33	0.004	0.48

a. Pen means (n = 32).

b. Represents the final average pen weight measured at the farm.

Note: Barrows are male swine and Gilts are female swine.

Answer choices:	(A) pigs	(B) sexes	(C) dietary supplements
	(D) pens	(E) investigators	(F) final weights

Name _____ Quiz Number _____ Date _____ / _____ / 2012

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- The degrees of freedom for testing treatment are _____.
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Salmon build nests (redds) in the gravel bottoms of streams. The eggs are spawned on these nests and covered with gravel. The levels of dissolved oxygen in the water and the permeability of the stream bed are important variables in spawning success. A student of fisheries biology is examining the physical and chemical aspects of salmon spawning grounds. One of the relationships of interest is the percent of fine gravel (<2 mm diameter) because it is related to permeability and hence oxygen supply to the salmon eggs.

To take samples of the stream bed the student inserted a pipe into the streambed and filled the pipe with liquid nitrogen. This freezes the stream bed sediment next to the core which can then be extracted and later thawed to determine stream bed characteristics.

The student located 9 redds and used his frozen sample technique to obtain 4 core samples inside each redd and 4 cores outside, but right next to, each redd. This provides a total of 72 observations. What type of analysis would be used in determine if the percent of fine gravel (< 2 mm) differed inside and outside the redds?

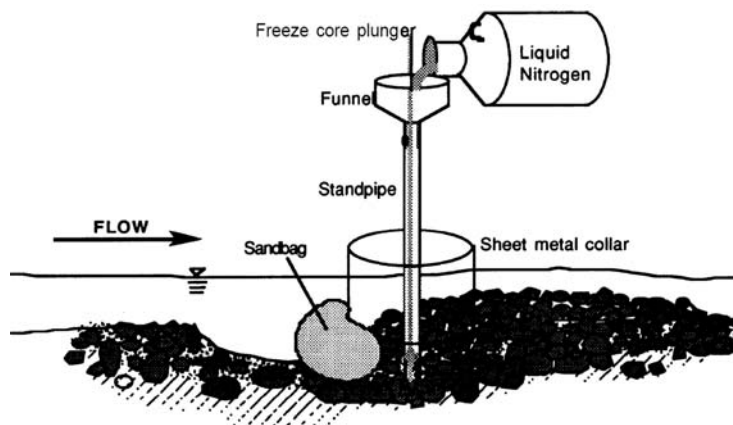


Figure 8. Freeze core sampling with the permeability/freeze core standpipe on coho redds in the Freshwater Creek basin, Humboldt County, 1988.

Answer choices:	(A) redd	(B) liquid nitrogen	(C) position (inside versus outside redd)
	(D) core	(E) percent fine gravel	(F) redd, position combination

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The effect of sulfur additions on Bermudagrass yield and nutrient levels of harvested forage was examined in a field study. The study was done in 2006 and 2007 on a Staser silt loam about 30 miles north of Nashville. Four Bermudagrass fields were used in the study. Each field was divided in two plots. All plots received additions of P, K and N according to soil test recommendations. Sulfur was applied at a rate of 22.4 kg S/ha to one plot in each field and at 44.8 kg S/ha to the other. Forage was harvested in 91 cm swaths through each plot at a height of 10.2 cm. The swaths were of equal length in each plot and the total harvest of bermudagrass was recorded.

Representative samples were also obtained for dry matter and nutrient analysis.



For our purposes of interest is the total harvest (kg) of Bermudagrass in the 91 cm equal length swath through each plot. The two levels of sulfur addition are to be compared for this variable.

Statistical analysis revealed there was no significant yield response to S applications ($P < 0.05$). There were no significant effects of S on nutritional quality measurements of NDF, ADF, P, K, Ca, Mg, Mn, Zn, S or TDN with the exception of copper (Cu), which showed a highly significant ($P < 0.01$) decrease in levels as S rate increased.

Answer choices:	(A) plot	(B) sulfur addition	(C) additions of P, K and N
	(D) fields	(E) total harvest	(F) cows

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An experiment was conducted to examine the effect of supplementing different green feeds (water spinach, sweet potato leaves and duckweed) to broken rice based diets on performance of various factors in 204 hens during a 17 week experiment. The experiment was carried out in the experimental farm of Cantho University from October 2003 to February 2004. The experimental animals were female Luong Phuong chickens at 4 weeks of age. The experiment consisted of 4 diets with 3 replicate pens for each diet with 17 chickens per pen. The diets were (1) Control diet: Mixed diet without any green feed, (2) DW: Mixed diet + duckweed (*ad libitum*), (3) WS: Mixed diet + Water spinach (*ad libitum*) and (4) SP: Mixed diet + Sweet potato vines (*ad libitum*).



A number of variables were measured on the chickens including Live weight (g), Carcass weight (g), Carcass yield (%), Liver weight (g), Gizzard weight (g), Caecum length (cm), Abdominal fat (g) and the chemical composition of breast and thigh meat (protein, fiber, ash, etc). A number of variables were also measured on factors related to egg production such as age at 1st egg (days), egg weight (g), and egg yolk weight and color (Lightness, Greenness and Yellowness) at the 4th week of laying. For our purposes the variable of interest will be the combined mean weight gain of the 17 chickens in each pen at the end of the experiment.

Answer choices:	(A) pens	(B) combined live weight	(C) egg yolk weight
	(D) diets	(E) individual chicken weight	(F) experimental farm

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An experiment was conducted to compare production of bell peppers planted in 4 different densities (29040, 14520, 9680 and 7260 plants per acre). The experiment was replicated on three raised beds. Each raised bed was 6 inches high, covered with plastic mulch and provided with plastic tubing for drip irrigation. Each of the four plant densities were planted on each raised bed as double row of evenly staggered plants. The four densities correspond to plant spacing of 0.5, 1.0, 1.5, and 2.0 ft between plants in the row were separately randomized for each raised bed. Peppers were harvested as soon as they ripened during 4 inspections between Sept 5 and Oct 4. The total harvest for each of the 4 plant densities on each of the 3 beds was recorded (12 values in all). A table of harvest results is given below. The objective is to compare bell pepper yields for the 4 levels of plant population densities.



Bell pepper marketable yield and average fruit weight				
Population (plants/acre)	Marketable yield			Avg. fruit wt. (oz)
	(no/acre)	(lb/acre)	(%)	
29,040	118,400 a	41,760 a	77	5.7
14,520	118,600 a	41,020 a	85	5.5
9,680	109,700 a	38,400 a	84	5.6
7,260	90,500 b	31,300 b	84	5.6
LSD .05	10,100	3,800	7	NS

Answer choices:	(A) raised bed	(B) a pepper plant	(C) plant density
	(D) total harvest	(E) plastic tubing	(F) double row

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The effectiveness of (1) potassium bicarbonate, (2) neem oil, and (3) *Bacillus subtilis* were compared to the standard (4) organic lime sulfur/sulfur fungicide treatment for apples and an (5) unsprayed control for the prevention of apple scab and other fungal diseases. The trees used in the study were of the variety 'Empire' and were arranged at random in an experimental orchard at the University of Vermont Horticultural Research Center in South Burlington, VT. In 2007 five single trees were chosen at random to receive each of the five application types (25 trees in all). Trees were sprayed at the maximum label rates weekly from April to June and biweekly through July.



Selected results from Table 1.

Apple scab percent incidence on 'Empire' fruit.

Application type and rate/ha	Percent
(5) non-sprayed	25.2 a
(3) <i>Bacillus subtilis</i> 3.4 kg	22.4 ab
(2) neem oil 18.7 L	11.6 bc
(1) potassium bicarbonate 4.2 kg	11.2 bc
(4) sulfur 16.8 kg + lime sulfur 18.7 L	0.4 c

Disease percent incidence and severity on cluster leaves, terminal leaves, and fruit were assessed on 10 clusters and 10 terminals per tree on 20-21 Jun, 10 terminals per tree on 22-24 Aug, and 50 fruit per tree at harvest (1-2 Oct). For our purpose the variable of interest is the percent incidence (i.e. occurrence) of apple scab on the 50 fruit sampled in October (see results from table 1).

The alternative fungicides showed some activity against foliar apple scab compared to the non-sprayed treatment and the potassium bicarbonate and neem oil treatments had significantly less fruit scab than the non-sprayed treatment. However, the lime sulfur/sulfur treatment provided the best overall control of scab.

Answer choices:	(A) an apple	(B) application type	(C) terminal leaves
	(D) an apple tree	(E) apple scab % incidence	(F) maximum rate

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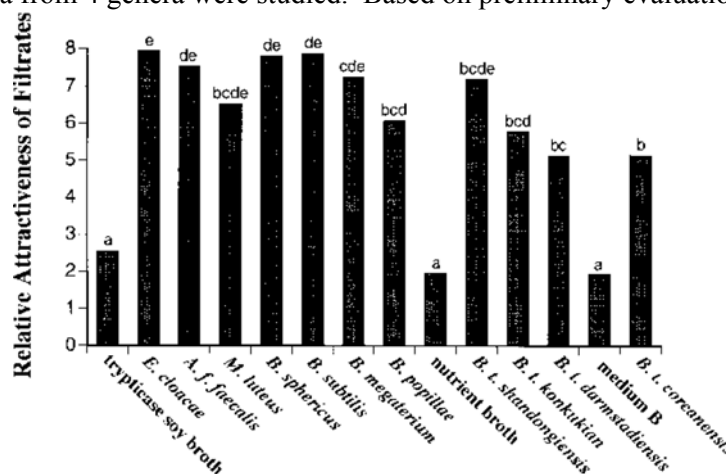
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Fruit flies are major fruit pests with the potential for causing considerable commercial damage. It is important to determine what factors cause the movement of flies among orchards and what attracts them to particular areas. The attractiveness of fermentation products produced by various types of bacteria was examined in this study. This was done in 3 steps, but we will concern ourselves only with the first step; the examination of the attractiveness of fermentation products from each bacterium. Filtrates were prepared from each of 11 bacterial species and 3 culture medium controls resulting in 14 combinations of bacteria and medium. Five fermentation batches were done in random order for each of the 14 filtrates.

In the first step, filtrates of 11 species of bacteria from 4 genera were studied. Based on preliminary evaluations of optimal growing conditions for each bacterial strain, all strains were fermented in either trypticase soy broth, Bacto-nutrient broth or culture medium B. These three growing mediums were also evaluated alone for attractiveness (as a control) in addition to the 11 bacterial fermentation filtrates giving a total of 14 filtrate examinations.

Evaluation was done by a bioassay conducted by putting a filter paper with the filtrate and a distilled water control paper on the top of a cage containing 180 to 200 fruit flies. The number of flies on each paper was counted once each minute for 10 minutes. The difference in the mean number of flies on the filtrate paper minus the mean number on a distilled water control was the value used as the measure of “attractiveness” for each bioassay. This process was done twice for each batch, producing two bioassay values of the attractiveness number for each filtrate. The objective of the study was to compare the attractiveness number of fermentation products from each bacterium and control. Two bioassays were conducted for each of the 5 fermentations of each of the 14 filtrates in random order (14 filtrates $\times$ 5 batches $\times$ 2 replicate bioassays = 140 values in all).



Answer choices:	(A) filtrates	(B) bioassay	(C) fermentation batch
	(D) cages	(E) individual flies	(F) attractiveness number

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This study examined the effects of the addition of *Entada abyssinica* prunings on maize yield and soil properties. This tree species is abundant and available so it was tested as a “green manure” where leafy biomass is added to the soil to increase fertility and reduce dependence on inorganic fertilizers. The large field used for this research was divided into five rows. Each row was then divided in five 30 x 15m plots (25 plots in all) and each plot then received one of the following types of additions: (1) a control, no addition, (2) 1.25 kg of cuttings added and mixed into the soil with a hoe, (3) 1.25 kg cuttings mulched on the surface,



(4) 2.50 kg of cuttings

added and mixed into the soil with a hoe, (5) 2.50 kg cuttings mulched on the surface. Each row received all 5 of the additions in randomly selected plots, separately randomized for each row.

The plots were planted in corn (i.e. maize) and numerous soil characteristics and soil nutrient levels were measured. We will concern ourselves only with the total yield of corn from each plot at the end of the experiment.



Answer choices:	(A) yield	(B) addition type	(C) soil characteristics
	(D) a row	(E) a plot	(F) a corn field

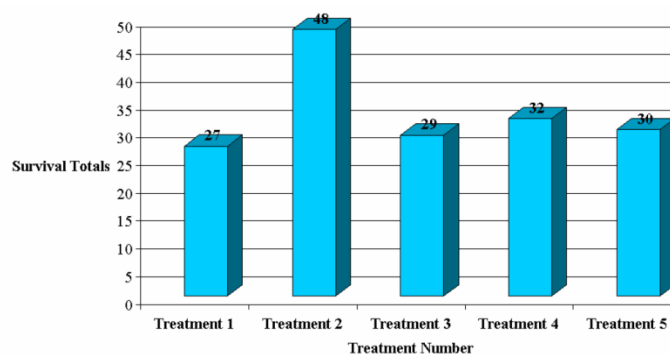
Name _____ Quiz Number _____ Date ____ / ____ / 2010

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Forestry production is limited in the Bolivian high plains. High altitude, low rainfall, and a variable climate all contribute to cause extremely high mortality rates among tree species. The purpose of this study was to examine whether microcatchment systems can improve tree establishment rates in the Bolivian high plains. Five different types of microcatchment systems were used: (1) Control. no microcatchment system (trees placed directly into the ground without any protection), (2) pit planting method (a simple 30-cm hole dug in the ground with one hole per seedling), (3) trench system (dug to a depth of 30 cm along a contour), (4) widened trench basin (trench depth still 30 cm and laid out along the contour but wider, approximately 60 cm) (5) slanted trench system (similar to number 4 with an additional trench dug 30 cm deeper inside to provide further water collection and protection).

The five microcatchment systems were planted in ten groupings along on a hillside with groupings spaced ten meters down slope from each other to provide for an adequate water catchment area. In each grouping 5 randomly selected sites were marked and the five microcatchments were randomly assigned to one of the sites in each grouping. Two tree species, one native (*Polylepsis tarapacana*) and one introduced (*Cupressus macrocarpa*), were planted in each of the treatments at the beginning of the rainy season. Three replicates of each tree species were spaced 1.5 meters (5 feet) apart from each other. The variable of interest was the percent survival for each microcatchment combination in each grouping. The data was analyzed for each tree species separately and **for both species combined**. We will consider percent survival of both species combined (6 trees) to be the variable of interest, so the 5 microcatchments in 10 groups provides a total of 50 sites, each with only a single value for the percent survival. Results for the two species combined are shown in the graph.



Answer choices:	(A) microcatchment type	(B) grouping	(C) tree species
	(D) Sites within groups	(E) percent survival	(F) hillside

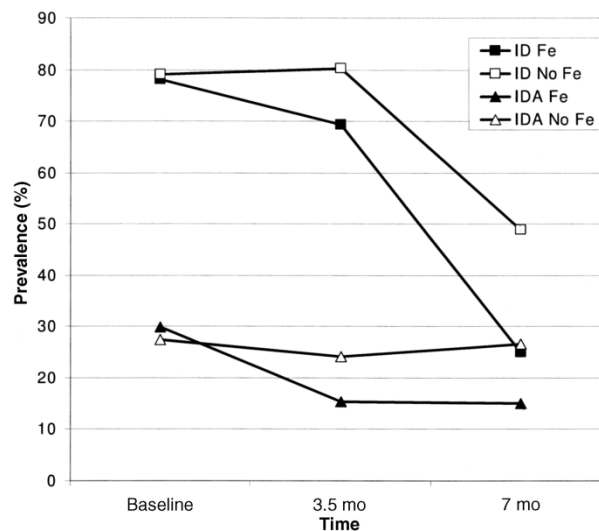
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Iron deficiency (ID) and iron deficiency anemia (IDA) are highly prevalent among young women and children in South and Southeast Asia. Iron fortification of rice could be an effective strategy for reducing iron deficiency anemia. The authors wanted to determine if extruded rice grains fortified with micronized ground ferric pyrophosphate (MGFP) would increase body iron stores in children.

In a double-blind, 7-mo, school-based feeding trial in Bangalore, India, iron-depleted, 6 to 13-year-old children ($n = 184$) were randomly assigned to receive either a rice-based lunch meal fortified with 20 mg Fe as MGFP or an identical but unfortified control meal. The meals were consumed under direct supervision, and daily leftovers were weighed. All children were dewormed at baseline and at 3.5 months. Iron status (ID) and hemoglobin (IDA) were measured at baseline, 3½ mo., and 7 mo. The variable of interest is the prevalence of iron deficiency (lower is better) at 0, 3½ and 7 months. Both variables, ID and IDA are shown in the graph but these are considered to be two separate analyses. For our purposes we are interested only in the prevalence of IDA, the iron deficiency anemia.



Answer choices:	(A) prevalence of IDA	(B) children	(C) 0, 3½ and 7 months
	(D) iron supplement	(E) rice-based meal	(F) feeding trial

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Sweet potato (SP) is grown as dry season forage for sheep. In order to study the effect of the cutting schedule on the yield and quality, Sweet potato forage vines were subjected to four cutting regimes: pruning at 4, 6, 8 week intervals and uncut plots (control plots).

The experiment spanned a period of 216 days (about 31 weeks) and was conducted on a field that had been left to fallow for a year after several years of cultivation to maize and cassava crops. A dual-purpose variety of sweet potato collected from the National Root Crops Research Institute (NRCRI) of Nigeria was used in this study. The vines were cut into 30 cm pieces with a minimum of 4 nodes. The plot size in this experiment was 4 x 6 m. Plots were created in 3 groups of 4 so each treatment was replicated three times, randomly assigned to one plot in each plot group.

Results were presented as dry matter (DM) yield of forage, roots and the total biomass yield measured at 4, 6, 8 weeks cutting intervals plus an uncut control plots. We will be concerned with forage as dry matter yield of a plot. Pruning at 6 and 8 week intervals significantly ($P < 0.05$) improved forage yield per plot at the expense of root yield.



Table 2. Dry matter yield (t/ha) of sweet potato cut at different intervals

Cutting interval, weeks	Forage	Root	Total biomass
4 weeks	8.58 ^b	4.34 ^c	12.92 ^b
6 weeks	11.95 ^a	5.08 ^b	17.03 ^a
8 weeks	12.16 ^a	5.96 ^b	18.12 ^a
Control	8.06 ^b	8.98 ^a	17.04 ^a
SEM	0.68	0.50	0.73

a, b, c: means with same superscripts within the column are not significantly different ($P > 0.05$)

Answer choices:	(A) plot groups	(B) Sweet Potato vines	(C) cutting regimes
	(D) uncut control	(E) dry matter yield	(F) a plot

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Carefully read the description of the experiment below. Be prepared to answer the questions that follow the design description as a class quiz.

This study examined the effects of water, both served with a food and incorporated into a food, on satiety. Four lean women consumed breakfast, lunch, and dinner in our laboratory 1 d/wk for 4 wk. Subjects received 1 of 3 preloads 17 min before lunch on 3 of the days and no preload on the other day (control). The

preloads consisted of

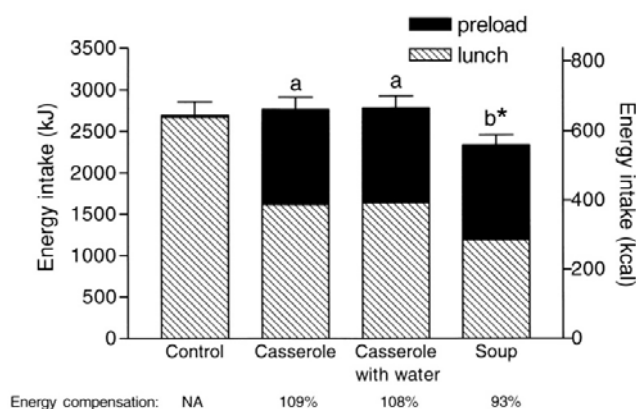
1) chicken rice casserole, 2) chicken rice casserole with a glass of water, 3)

chicken rice soup and (4) a no preload control. The soup contained the same ingredients (type and amount) as the casserole that was served with water.

Lunch consisted of a large variety of items. To avoid the possibility of subjects eating to "clean their plates," we presented more food than they were likely to consume. During all meals, subjects were instructed to eat as much of any food item as they wished and to ask for more if desired. All food items were weighed before and after consumption to obtain the amount consumed.

The four **women** were randomly administered the **preloads** over 4 days (a week apart) such that each woman received each preload once and each preload occurred once in each **week**. The table shows the manner in which the four diets (3 preloads and a control) were applied. The whole experiment was actually replicated 6 times on different women (24 total), but **for our purposes let's suppose it was done just once on 4 women over 4 weeks**. The variable of interest is the **energy intake** for each woman from each meal.

	Week 1	Week 2	Week 3	Week 4
Woman 1	Soup	Control	Casserole+water	Casserole
Woman 2	Casserole+water	Casserole	Control	Soup
Woman 3	Control	Soup	Casserole	Casserole+water
Woman 4	Casserole	Casserole+water	Soup	Control



Answer choices:	(A) preload	(B) week	(C) woman "i" in week "j"
	(D) replicate	(E) subject	(F) intake energy

Name _____ Quiz Number _____ Date _____ / _____ / 2012

Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
- What is the sampling unit for this experiment? A B C D E F
- What is the dependent variable for this experiment? A B C D E F
- What is the treatment variable for this experiment? A B C D E F
- If the design is RBD, what are the blocks? A B C D E F NA
- Does it seem more likely that the treatments are fixed or random? (A) fixed (B) random
- What is the treatment arrangement for this experiment? (A) single factor (B) factorial (C) nested
- What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- The treatment degrees of freedom are _____.
- The degrees of freedom for the error used for testing treatments are _____.

A 35-day feeding trial with Hubbard broilers (i.e. chickens) was carried out to evaluate the performance, nutrient utilization and organ characteristics of broilers fed *Microdesmis puberula* leaf meal at dietary levels of 0, 10 and 15%, respectively. *Microdesmis puberula* is a browse plant indigenous to Nigeria that is preferred by some ruminants, especially goats. The current study examines its suitability as a feed supplement for chickens.

One hundred and eighty, 5-week-old Hubbard broiler chicks were randomly assigned to 6 m × 8 m cages with 20 birds per cage. Each of the three diets was randomly assigned to 3 cages, giving a total of 60 birds in 3 cages receiving each diet. Feed and water were provided *ad libitum*. Feed intake was recorded daily and the birds were weighed weekly. Other routine poultry management procedures were maintained.



The feeding trial lasted 35 days.

At the end of 35 days a final body weight was determined and recorded for each bird individually. The variable of interest is the final body weight for each chicken at the end of the 35 day experiment.

Answer choices:	(A) percent leaf meal	(B) body weight	(C) chicken
	(D) cage	(E) feeding trials	(F) day

Name _____ Quiz Number ____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- 1) What is the experimental unit for this experiment? A B C D E F
- 2) What is the sampling unit for this experiment? A B C D E F
- 3) What is the dependent variable for this experiment? A B C D E F
- 4) What is the treatment variable for this experiment? A B C D E F
- 5) If the design is RBD, what are the blocks? A B C D E F NA
- 6) Does it seem more likely that the treatments are fixed or random? (A) fixed (B) random
- 7) What is the treatment arrangement for this experiment? (A) single factor (B) factorial (C) nested
- 8) What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- 9) The treatment degrees of freedom are _____.
- 10) The degrees of freedom for the error used for testing treatments are _____.

Endophytes are organisms that live within another organism without causing apparent harm. The endophytes in this study are fungi living in an invasive aquatic plant called Eurasian water milfoil.

A greenhouse study was conducted to test effects of stress induced by simulated chemical runoff on endophyte-infected and endophyte-free Eurasian water milfoil. Simulated chemical runoff stress was induced by applying low rates of the herbicide endothall for a 24-hour exposure time. Applications included no endothall (0 mg/L), 0.5 mg/L and 1.0 mg/L applied to both endophyte-infected and endophyte-free Eurasian water milfoil plants.

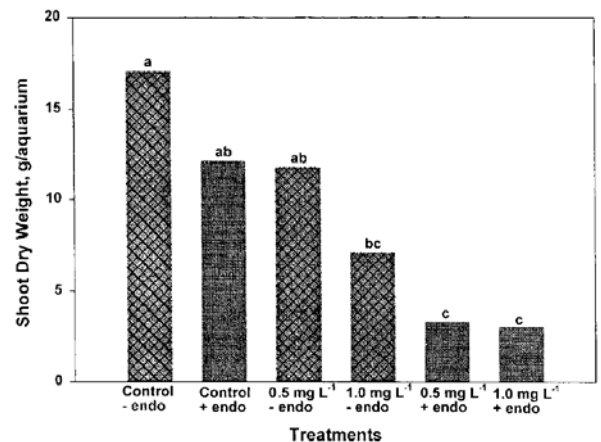
Eighteen 55 L aquaria were filled with a water based culture solution recommended for aquatic plant growth.



Lake sediment collected from Brown's Lake was amended with ammonium chloride (0.5 g/L) and Esmigran (1.7 g/L). Five plastic cups (0.95 L), each filled three-fourths with lake sediment and a 20-cm apical cutting from either endophyte-infected or endophyte-free Eurasian water milfoil, were placed in each aquarium (1 plant per cup, 5 cups per aquarium). Plants were then allowed to grow 28 days by which time they had formed surface canopies.

Each treatment was replicated three times in randomly assigned test aquarium (18 in all). After the 24-hour exposure to endothall, the aquaria were drained and refilled with nutrient solution. The plants were allowed to respond to the simulated chemical runoff applications for 4 weeks, sufficient to determine if Eurasian water milfoil would recover from the chemical treatments. The shoots

were harvested from each cup and oven-dried at 60°C. Plant biomass, measured as shoot dry weight in grams for each individual cup, was the variable of interest.



Answer choices:	(A) endothall	(B) aquaria	(C) endophyte (infected or free)
	(D) plastic cups	(E) biomass	(F) Brown's Lake

Name _____ Quiz Number _____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
- What is the sampling unit for this experiment? A B C D E F
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- What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- The treatment degrees of freedom are _____.
- The degrees of freedom for the error used for testing treatments are _____.

Aflatoxins, toxic metabolites of the mold fungi *Aspergillus flavus* or *Aspergillus parasiticus*, cause poor feed utilization, decreased weight gains, depressed immune function, liver dysfunction, coagulation abnormalities, and death in a wide variety of species including humans. Conservationists have become concerned that increasingly popular wildlife feeding or baiting practices could expose wildlife to toxic amounts of aflatoxin-contaminated grains, particularly corn. The effects of aflatoxins on the wild turkey (*Meleagris gallopova silvestris*) are of special concern because the conspecific domestic turkey is highly



susceptible to aflatoxins.

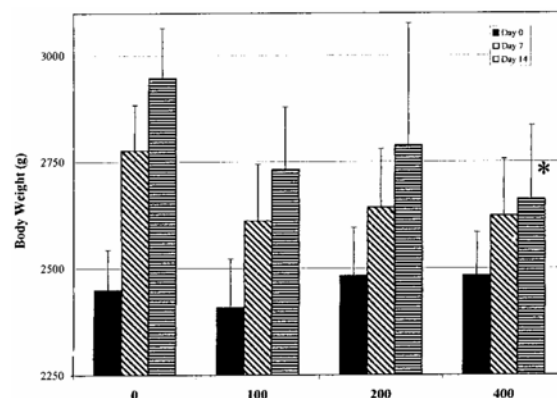


FIGURE 1. Average body weights ($\pm$ SD) of groups of 4-mo-old wild turkey poults fed 0, 100, 200, or 400 μ g aflatoxin/kg feed at 0, 7, and 14 days.

To evaluate the effect of dietary aflatoxin on wild turkey poults*, four groups of 4-mo-old poults were fed diets containing 0, 100, 200, or 400 μ g aflatoxin/kg feed for 2 wk in September and October 1996. Feeding trials were conducted at the University of Georgia Poultry Diagnostic and Research Center. When the birds were 3.5-mo-old, the poults were divided into four groups of 12 and assigned to one of 4 pens. Each pen was assigned one of four dietary treatments of 0 (control), 100, 200, and 400 μ g total aflatoxin/kg feed. Poults were banded for individual identification and baseline body weight was taken at the beginning of the study, on day 0. Turkey poults were weighed again at 7 and 14 days into the study. The variable of interest is body weight. * a poult is a turkey hatchling, a very young turkey

Answer choices:	(A) poults	(B) aflatoxin diets	(C) body weight
	(D) pen	(E) days	(F) humans

Name _____ Quiz Number _____ Date ____ / ____ / 2012

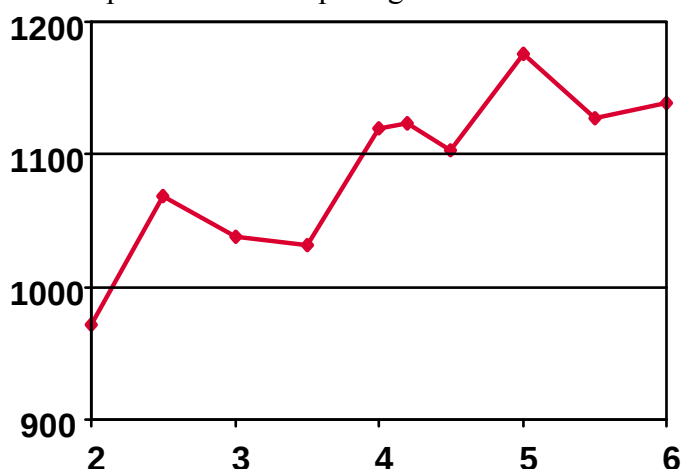
Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
- What is the sampling unit for this experiment? A B C D E F
- What is the dependent variable for this experiment? A B C D E F
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- The treatment degrees of freedom are _____.
- The degrees of freedom for the error used for testing treatments are _____.

ABSTRACT: Cotton producers are looking for ways to economize on cottonseed when it comes to planting, but without sacrificing yields. A study was conducted on a producers' field in Claiborne County 3 miles east of Port Gibson on upland loamy soil to evaluate planting population densities. Cotton was planted on 4 raised beds which were rolled to provide a smooth planting surface. On each of the 4 raised beds, seeds were planted on 10 plots of 4 rows per plot. Seeds were planted in the 10 plots at densities of 2, 2.5, 3, 3.5, 4, 4.2, 4.5, 5, 5.5 and 6 seeds/ft of row. Densities were randomly assigned to the 10 plots in each of the 4 beds (40 plots in all) such that each density occurred once in each bed. Cotton was then picked in mid-October with a picker adapted for picking each 4-row plots as a single sample. The variable of interest was lint yields, which ranged from 1176 lb lint/ac with 5 seeds/ft of row to 972 lb lint/ac with 2 seeds/ft of row. The 5 and 6 seeds/ft of row yields were significantly higher than the other seeding rates.

Table 1. Plant population and lint yield of cotton planted in seed spacing test.

Seed planted / ft of Row	Plant Population	Lint Yield/ac
2.0	27,000	972
2.5	34,000	1069
3.0	41,000	1038
3.5	48,000	1031
4.0	55,000	1120
4.2	57,000	1124
4.5	61,000	1103
5.0	68,000	1176
5.5	75,000	1127
6.0	82,000	1139
LSD	0.05	160



Answer choices:	(A) a row	(B) a bed	(C) a plot
	(D) yield	(E) seeds	(F) densities

Name _____ Quiz Number ____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
- What is the sampling unit for this experiment? A B C D E F
- What is the dependent variable for this experiment? A B C D E F
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- What is the treatment arrangement for this experiment? (A) single factor (B) factorial (C) nested
- What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- The treatment degrees of freedom are _____.
- The degrees of freedom for the error used for testing treatments are _____.

An Agricultural researcher is interest in the effect of competition for light by Sugar Beet plants. Sugar beets average about 22 inches high, and many weeds that infest the sugar beet fields surpass this height. Wild mustard, for example, averages about 26 inches.

The researcher establishes a single sugar beet field with 60 rows, each 10 m long with suitable buffer zones. Each row is seeded with sugar beets at the usual commercial rate and with wild mustard plants at one of 6 six densities (10 rows were randomly allocated to each mustard infestation rate). The rates of mustard infestation were 0, 2, 4, 8, 16 and 32 plants per row). The variable of interest is the sugar beet harvest biomass recorded for each row.



Answer choices:	(A) a sugar beet plant	(B) mustard plant density	(C) a row
	(D) harvest biomass	(E) 22 inch height	(F) buffer zone

Name _____ Quiz Number ____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- 1) What is the experimental unit for this experiment? A B C D E F
- 2) What is the sampling unit for this experiment? A B C D E F
- 3) What is the dependent variable for this experiment? A B C D E F
- 4) What is the treatment variable for this experiment? A B C D E F
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- 8) What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- 9) The treatment degrees of freedom are _____ .
- 10) The degrees of freedom for the error used for testing treatments are _____ .

A student from an Agricultural Engineering school is studying the use of cow and pig manure as fertilizer (manure source is of interest). The manure was applied in one of two forms, fresh or



processed (manure form is also of interest). The fresh manure was applied before



planting and again after 3 months. The processed manure was applied every 3 days as a liquid effluent from a “biodigester”. The four combinations were then cow-fresh, pig-fresh, cow-effluent and pig-effluent.

The four combinations were applied to a cassava crop for 5 months (1/12/97 to 30/4/98). The cassava plants were arranged in three irrigated fields such that each treatment occurred once in each field in a randomly assigned 4 x 2.5 m plot. Fields are a potential source of variation, but is not a source of interest. How would this experiment be analyzed if the variable of interest was the total combined biomass from two harvests (at 3 and 5 months) from the plots in each field, at total of 12 values?

Answer choices:	(A) manure source	(B) manure form	(C) fields
	(D) total biomass	(E) months	(F) plot

Name _____ Quiz Number _____ Date _____ / _____ / 2012

Circle the appropriate letter for each question.

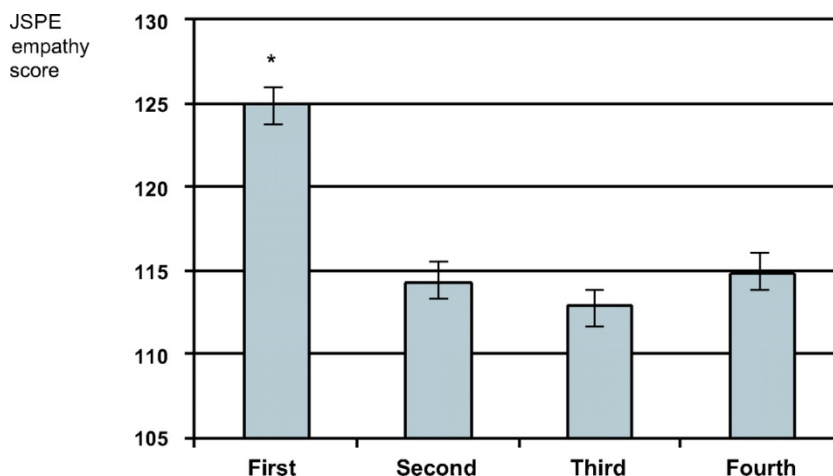
- 1) What is the experimental unit for this experiment? A B C D E F
- 2) What is the sampling unit for this experiment? A B C D E F
- 3) What is the dependent variable for this experiment? A B C D E F
- 4) What is the treatment variable for this experiment? A B C D E F
- 5) If the design is RBD, what are the blocks? A B C D E F NA
- 6) Does it seem more likely that the treatments are fixed or random? (A) fixed (B) random
- 7) What is the treatment arrangement for this experiment? (A) single factor (B) factorial (C) nested
- 8) What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- 9) The treatment degrees of freedom are _____.
- 10) The degrees of freedom for the error used for testing treatments are _____.

Empathy in the health care setting is the ability to understand a patient's experiences and feelings and the capability to communicate this understanding. Empathy plays an important role in the dentist-patient relationship. We examined the psychometric properties of a measure of empathy applied to the dental school setting and compared levels of empathy in dental students across their four years of training. One hundred and thirty students completed a survey including the Jefferson Scale of Physician Empathy (JSPE).

The study sample consisted of 130 dental students (eighty-five men, forty-five women) at the University of Washington School of Dentistry. This represents 61 percent of the total student body at the time the survey was administered, a response rate

considered "good" for mail survey research. Of the 130 respondents, 43 were first-year dental class students, 29 were second-year class, 27 were third-year, and 31 were in the fourth-year dental class.

The Jefferson Scale of Physician Empathy-Health Professionals Version (JSPE-HP) was used to measure empathy in our subjects. The JSPE includes twenty items answered on a 7-point Likert scale (1=strongly disagree through 7=strongly agree). We were interested in comparing empathy for the years of training for the dental students. The score on the JSPE questionnaire was our variable of interest.



Answer choices:	(A) JSPE-HP score	(B) student	(C) Likert scale
	(D) class year	(E) survey	(F) total student body

Name _____ Quiz Number ____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- 1) What is the experimental unit for this experiment? A B C D E F
- 2) What is the sampling unit for this experiment? A B C D E F
- 3) What is the dependent variable for this experiment? A B C D E F
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- 9) The treatment degrees of freedom are _____.
- 10) The degrees of freedom for the error used for testing treatments are _____.

Increase herb consumption in United States has grown significantly and oregano is the most important in terms of both quantity and in dollar value. Thymol and carvacrol are the two major compounds in the essential oil obtained from Mexican oregano and are of special interest due to their antioxidant and antimicrobial properties. This study examines the effect of moisture and growth stage on the thymol and carvacrol composition of Mexican oregano.

The greenhouse experiment was conducted (ambient temperature at 22-24°C and a photoperiod of 16 h daylight and 8 h night) on seedlings that were started in perforated plastic tubes (5 oregano seeds/tube) and transplanted at two-months old to individual plastic pots (1 plant/pot) filled with a commercial peat mixture. There were 4 watering schemes (0.2, 0.4, 0.8 and 1.2 L water/pot/15 days) and 3 growth phases (seedling = 30 days after transplant (S), full bloom = 60 days after transplant (F) and maturity = 90 days after transplant (M)). Five replicate pots were done for each of the 12 combinations of watering and growth phase. Each replicate consisted of one plant per pot whose leaves were harvested, dried at room temperature, had the essential oil extracted using a laboratory scale steam distillation unit and analyzed by gas chromatography. All extraction runs and analyses were carried out in duplicate and in randomized order with the **mean values being reported with one value for each plant**. Several variables were measured, but we will use only carvacrol % concentration as our variable of interest.

Table 2. Effect of moisture and plant growth on the thymol and carvacrol concentration (% w/w) and oil content (% w/w) of Mexican oregano

Treatment ¹	Oil Amount	Thymol	Carvacrol
S0.2	2.3 ^{a,b,c}	43.4 ^{a,b}	25.0 ^b
S0.4	2.5 ^a	37.1 ^{a,b}	25.5 ^b
S0.8	2.0 ^{a,b,c,d}	46.7 ^{a,b}	24.5 ^b
S1.2	2.4 ^{a,b}	40.2 ^{a,b}	21.1 ^b
F0.2	1.5 ^{b,c,d,e}	27.8 ^{a,b}	50.0 ^a
F0.4	1.9 ^{a,b,c,d}	38.1 ^{a,b}	24.6 ^b
F0.8	1.8 ^{a,b,c,d}	38.1 ^{a,b}	29.0 ^{a,b}
F1.2	1.8 ^{a,b,c,d}	53.9 ^a	29.9 ^{a,b}
M0.2	2.3 ^{a,b,c}	22.7 ^b	29.0 ^{a,b}
M0.4	1.2 ^{d,e}	45.5 ^{a,b}	31.9 ^{a,b}
M0.8	0.7 ^e	40.9 ^{a,b}	19.1 ^b
M1.2	1.5 ^{d,e,c}	43.2 ^{a,b}	15.7 ^b

Means in the same column with the same alphabet are not significantly different at $P=0.05$. ¹Please see Table 1 for the explanation of treatment labels.

Answer choices:	(A) replicates	(B) plant or pot	(C) carvacrol concentration
	(D) watering schemes	(E) growth phases	(F) commercial peat mixture

Name _____ Quiz Number _____ Date _____ / _____ / 2012

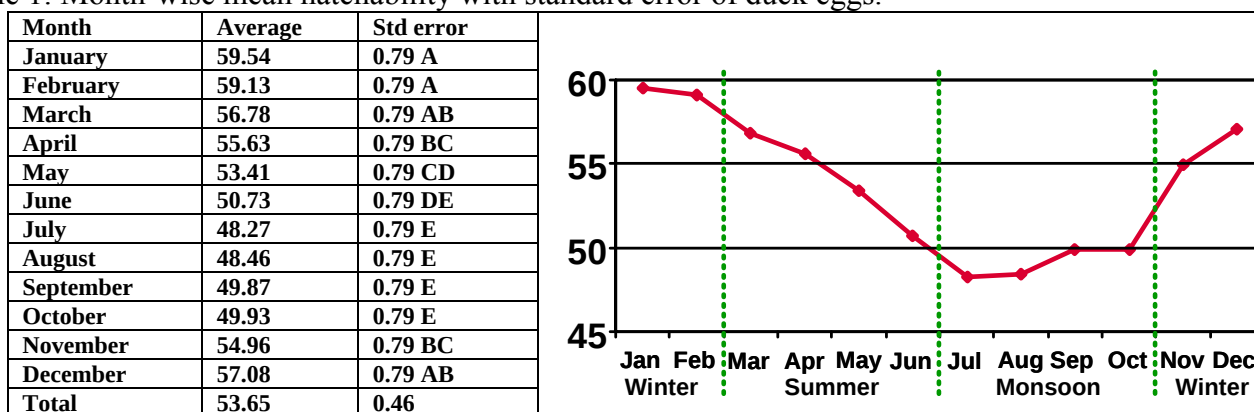
Circle the appropriate letter for each question.

- 1) What is the experimental unit for this experiment? A B C D E F
- 2) What is the sampling unit for this experiment? A B C D E F
- 3) What is the dependent variable for this experiment? A B C D E F
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- 9) The treatment degrees of freedom are _____.
- 10) The degrees of freedom for the error used for testing treatments are _____.

A study was done at the Regional Duck Breeding Farm in Daulatpur, Khulna, Bangladesh. The objective was to examine the seasonal effect on duck eggs hatchability. Eggs were placed in an incubator and the number of eggs hatched was used to determine the hatchability percentage. Good quality, clean, medium-size eggs were collected for hatching. Hatchability was calculated on the basis of the number of eggs set into the incubator and the number of duckling hatched each month. Data were collected from 1995 to 2002, yielding 12 months of data for 8 years, for 96 observations. During this period 5,199,928 eggs were incubated and 2,789,000 ducklings were hatched. Years will differ, but year differences were not a variable that the investigator was interested in testing.

Data were examined **separately** to test for differences in the 12 months and to test for differences in the three seasons: summer (March-June), monsoon or rainy (July-October), and winter (November-February). The result revealed that hatchability of duck eggs were highest in January (59.54%) and lowest in July (48.27%) in case of month wise hatchability whereas winter (57.676%) shows the highest followed by summer (54.135%) and monsoon or rainy season (49.134%). **For our purposes consider the hatchability on a monthly basis as the variable of interest over the 8 years. Ignore seasons!**

Table 1: Month-wise mean hatchability with standard error of duck eggs.



Answer choices:	(A) months	(B) eggs	(C) year by month combinations
	(D) years	(E) duckling	(F) hatchability

Name _____ Quiz Number _____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
- What is the sampling unit for this experiment? A B C D E F
- What is the dependent variable for this experiment? A B C D E F
- What is the treatment variable for this experiment? A B C D E F
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- What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- The treatment degrees of freedom are _____.
- The degrees of freedom for the error used for testing treatments are _____.

A study was performed to determine the “natural” wood preferences of subterranean termites (Isoptera) in a field feeding experiment. The experiment was done in a 2,000 m² garden area of the Universidade Federal Rural do Rio de Janeiro at two subterranean termite infestation spots. Pieces of wood were cut from heartwood or sapwood of 8-year-old trees of *Pinus sp.* and three species of Eucalyptus: *E. pellita* (red mahogany), *E. urophylla* (Timor mountain gum), and *E. robusta* (swamp mahogany).

The experiment consisted of sixty stakes of each forest species (240 stakes in all), each 2.5 cm long by 3.0 cm width and 2.5 cm thick. The stakes were submerged in water for 4 different immersion periods of 0, 24, 48 and 72 hours. Stakes were installed in groups of four (one of each wood species) at 0.5 m intervals with 4-stake groupings arranged completely at random. The stakes were driven vertically into the soil with approximately $\frac{1}{5}$ of the total length protruding above ground. Five replicate stake groupings of each of the 4 water immersion periods were removed from the soil at 30, 45 and 60 days (80 stakes each exposure period). Stakes were inspected for infestation by subterranean termites. Preference of subterranean termites was determined as the percentage of termite-damaged stakes for each wood species for each of the different water immersion periods at each field exposure period.

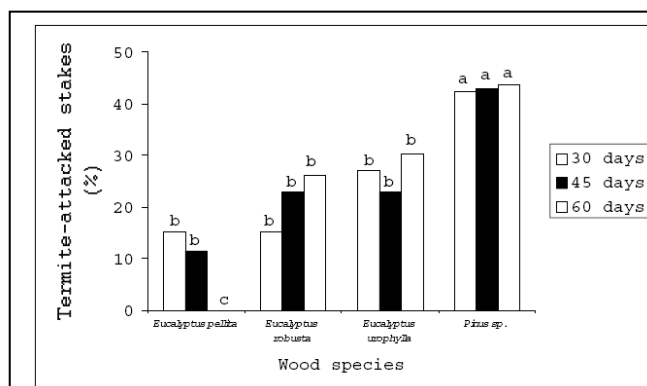


Figure 1. Percentage of stakes of each wood species attacked by termites at 30, 45, and 60 day exposure periods. Averages within the same exposure period with the same letter are not significantly different as gauged by Tukey's test ($P \leq 0.05$).

Note: Total stakes = 4 wood species x 4 emersion times x 3 exposure periods x 5 replicates = 240.

Answer choices:	(A) wood species	(B) a stake	(C) exposure periods
	(D) emersion times	(E) a stake group	(F) Percent damage

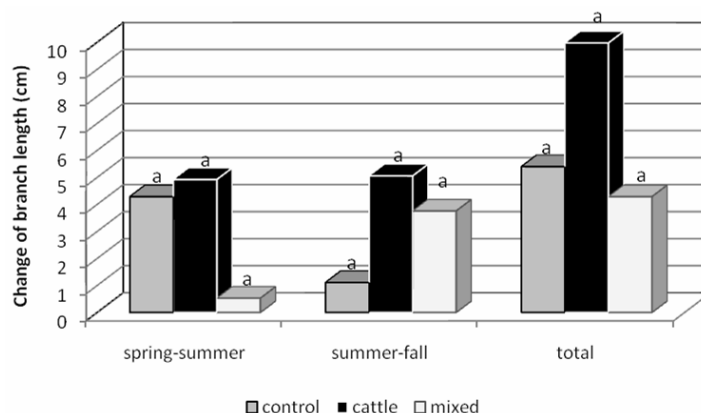
Name _____ Quiz Number ____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
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- The treatment degrees of freedom are _____.
- The degrees of freedom for the error used for testing treatments are _____.

Goats were examined as a possible control for invasive plant species like multiflora rose, autumn olive, and *Sericea lespedeza* in a study of reclaimed Appalachian-region coal-mined lands currently used for beef cattle production. The return from grazing cattle is too low to justify most methods of controlling invasive plants on the steep hillsides, so goats were examined as a possible alternative.

An experiment was conducted in 2006 and 2007 at the Powell River Research and Education Center near Wise, VA, to determine the effects of grazing. The grazing schemes were (1) an ungrazed control, (2) cattle grazing alone, and (3) mixed grazing goats with cattle. All grazing schemes were sampled during 2 distinct grazing seasons. Two fenced areas were used as the control and three fenced areas each for the two grazed applications. A number of variables were measured in each fenced area during the two grazing seasons like types and nutritive values of vegetation, forage biomass, botanical composition and relative abundance of plant species and shrub survival. One variable measured was branch length of autumn olive (from the base of the branch to the end tip). From this variable the investigators calculated values for change in branch length. This is our variable of interest.



Answer choices:	(A) fenced area	(B) grazing schemes	(C) Appalachian region
	(D) a goat	(E) grazing season	(F) change in branch length

Name _____ Quiz Number ____ Date ____ / ____ / 2012

Circle the appropriate letter for each question.

- What is the experimental unit for this experiment? A B C D E F
- What is the sampling unit for this experiment? A B C D E F
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- The degrees of freedom for the error used for testing treatments are _____.

A table by the Consumers Union is cited in a report by the National Highway Traffic Safety Administration, Department of Transportation (49 CFR Part 575, [Docket No. NHTSA-2001- 9663; Notice 2], RIN 2127-AI81, Consumer Information Regulations; Federal Motor Vehicle Safety Standards; Rollover Resistance.). That table is given below.

Table 5: Maximum Achievable “Clean” Run Speeds For the Consumers Union Short Course Double Lane Change Maneuver – Nominal Vehicle Configuration

Test Driver	2001 Chevrolet Blazer (mph)	2001 Ford Escape (mph)	1999 Mercedes ML320 with ESC On (mph)	1999 Mercedes ML320 with ESC Off (mph)	2001 Toyota 4Runner with ESC On (mph)	2001 Toyota 4Runner with ESC Off (mph)
GF	39.3	37.0	38.8	36.7	36.5	37.7
LJ	38.1	37.1	37.1	36.6	37.4	35.7
RL	40.7	40.5	39.2	38.3	37.8	37.8

Suppose we are willing to assume that the “Maximum Achievable ‘Clean’ Run Speeds” are normally distributed. We now want to test for differences between the types of vehicles. We are not interested in differences between drivers, but of course we must recognize that they represent a potential source of variation. There was only one of each type of vehicle (6 in all) and each vehicle was driven by the same 3 drivers. A single clean run speed was recorded for each driver in each vehicle as a “best of 3” tries, hence the “maximum” clean run speed.

Answer choices:	(A) vehicle type	(B) drivers	(C) car by driver combinations
	(D) run speeds	(E) year	(F) Consumers Union

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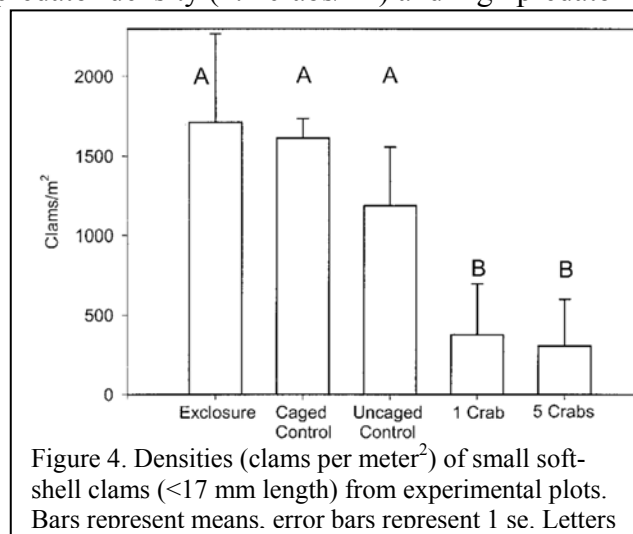
Circle the appropriate letter for each question.

- 1) What is the experimental unit for this experiment? A B C D E F
- 2) What is the sampling unit for this experiment? A B C D E F
- 3) What is the dependent variable for this experiment? A B C D E F
- 4) What is the treatment variable for this experiment? A B C D E F
- 5) If the design is RBD, what are the blocks? A B C D E F NA
- 6) Does it seem more likely that the treatments are fixed or random? (A) fixed (B) random
- 7) What is the treatment arrangement for this experiment? (A) single factor (B) factorial (C) nested
- 8) What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- 9) The treatment degrees of freedom are _____.
- 10) The degrees of freedom for the error used for testing treatments are _____.

In late May to early September 2001 the impact of Green Crab (*Carcinus Maenas* L.) predation on soft-shell clams (*Mya arenaria*) was investigated with caging experiment carried out on an estuarine mudflat in Pomquet Harbour, Nova Scotia. Cages were constructed of plastic-coated wire, with a square mesh opening of 1×1 cm. Six replicate cages (0.83 m^2) were set up for each cage type. Cage types were as follows: (1) enclosure cages with no predators added, (2) control cages with 20×70 cm portions of each side removed allowing for unrestricted predator movement, (3) undisturbed mudflat 0.83 m^2 area adjacent to the cage matrix used as an uncaged control, (4) low-predator-density cages with 1 crab added, and (5) high-predator-density cages with 5 crabs added. The low predator density (1.2 crabs/m^2) and high predator density (6.1 crabs/m^2) were chosen to reflect densities estimated by previous researchers.

To reduce the potential impact of environmental heterogeneity, cages were grouped in 6 rows oriented perpendicular to the slope of the mudflat. One of each cage type was randomly assigned to a position in each row with 1 m between the cages. The fifth “cage type” (open mudflat controls) was located adjacent to each row of cages. All 5 cage types were present in each row.

Green crabs trapped the previous day were added to the appropriate cages by cutting a small flap in the cage, adding crabs, and closing the flap with plastic cable ties. Approximately 3 months after deployment the cages were removed from the substratum. All sediment inside the cages was excavated to a depth of 30 cm and sieved to collect soft-shell clams. The undisturbed mudflat control plots were subjected to the same sampling regimen. Clams were counted separately as large (>17 mm in length) or small (<17 mm). The crabs prey upon the smaller clams, so this was the variable of interest.



Answer choices:	(A) small clam number	(B) row	(C) estuarine mudflat
	(D) a cage	(E) Green crabs	(F) cage type

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Circle the appropriate letter for each question.

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- What is the sampling unit for this experiment? A B C D E F
- What is the dependent variable for this experiment? A B C D E F
- What is the treatment variable for this experiment? A B C D E F
- If the design is RBD, what are the blocks? A B C D E F NA
- Does it seem more likely that the treatments are fixed or random? (A) fixed (B) random
- What is the treatment arrangement for this experiment? (A) single factor (B) factorial (C) nested
- What is the experimental design? (A) CRD (B) RBD (C) LSD (D) Split-plot (E) Repeated Measures
- The treatment degrees of freedom are _____.
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This study was conducted in Metema in the Amhara National Regional State of Ethiopia. Agricultural production throughout the study area is mixed crop/livestock by small landowners. The major crops grown include sorghum, rice, cotton, sesame, haricot bean and soybean, but the farming systems can be broadly classified as cotton based farming and sesame based farming.

Most farmers also raise goats and benefits of supplemental protein feed sources from locally available materials were examined in this study. The supplemental feeds were noug seedcake, sesame seedcake and cotton seedcake. All supplemented diets also received wheat bran and there was also a grazing only control. Five farmers volunteered to participate in the study. Twenty young, male goats of similar age and weight were purchased and four were randomly assigned to each farmer. All experimental goats grazed on the communal pasture on each farm for most of the day. After grazing the experimental goats were watered and then tethered with their supplemental feed. Each of the 5 farmers had one goat receiving each of the 4 supplemental feed sources. The variable of interest is the average daily weight gain (ADG) for each goat during the study.

Initial weight (IW), final weight (FWT) and average daily gain (ADG) of goats with and without dietary protein supplements including wheat bran (WB) plus other local oil seedcakes.			
Treatment	IW (kg)	FWT (kg)	ADG (g/day)
Overall mean $\pm$ se	22.35 $\pm$ 0.12	27.09 $\pm$ 0.19	52.61 $\pm$ 2.01
R ²	0.97	0.92	0.76
CV (%)	2.35	3.14	17.4
Standard Error	0.23	0.38	4.09
Test of Treatments (F, P value)	1.15, 0.3683	11.98 0.0006	11.37 0.0008
Grazing only	22.4	25.5 a	34.4 a
Grazing + noug cake +WB mixtures	22.4	27.2 b	52.9 b
Grazing + sesame cake +WB mixtures	22.0	27.0 b	55.1 b
Grazing + cotton cake +WB mixtures	22.6	28.7 c	68.0 c
Means with the same letter within the same column are not significantly different.			



Answer choices:	(A) supplemental feeds	(B) a goat	(C) farmers or farms
	(D) farming systems	(E) pasture	(F) daily weight gain (ADG)

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Circle the appropriate letter for each question.

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