

**Instructions:**

Complete 10 questions; Question #1 (required) and 9 others  
All questions are worth the same: 10 points per question.  
Show all computational work and units where applicable.  
'Closed book' exam; one page of notes is allowed.

**Question 1 (Required)**

For your favorite forage species, state:

- Common name (0) .....
- Latin/Scientific name (1): .....
- One common cultivar (1): .....

Write one key point on each of the following:

The most distinguishing morphological feature to identify the species (2)

.....

What is the main advantage that makes this your favorite forage (2):

.....

The biggest disadvantage or limitation of this species (2):

.....

One important management issue for using this species (2):

.....

**Question 2**

For the species that you identified in Question 1, write 5 bullet-style points describing more detailed aspects of the species not mentioned in Question 1. For example, sensitivity/tolerance to the environment/climate, drought/freeze tolerance, grazing suitability, insect/disease tolerance, feed quality, fertilizer requirements, insect/disease issues or other details.

- a)
  
  
  
  
  
  
  
  
  
  
- b)
  
  
  
  
  
  
  
  
  
  
- c)
  
  
  
  
  
  
  
  
  
  
- d)
  
  
  
  
  
  
  
  
  
  
- e)

**Question 3**

Where are the meristematic zones found in:

- a) grasses (2)

.....

- b) 'crown-type' legumes such as red clover and alfalfa (2)

.....

- c) 'creeping' legumes such as white clover (2)

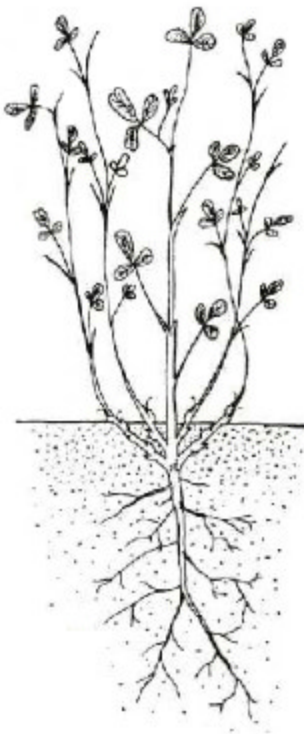
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Why is it important to know the locations and types of meristems in forages? How does this information affect plant growth, and influence crop management decisions? (4)

**Question 4**

In either of the following diagrams of two forages, label a:

- a) tiller      b) plant crown      c) legume meristem      d) lamina      e) petiole
- f) true stem      g) sheath (or pseudostem)      h) grass meristem      i) ligule      j) auricles



### Question 5

Complete the sentence with the most appropriate keyword from the list provided

- a) ..... are above-ground creeping stems found in white clover and Kentucky bluegrass
- b) The structural carbohydrates in forages that are partially-digestible by livestock are .....
- c) Cool-season species have a temperature optimum for growth around 20°C, but ..... grasses have a temperature optimum around 30-35°C
- d) The cation-exchange capacity of soil results from the dissociation of ..... from soil particles, leaving areas of localized negative charge which can attract soil cations
- e) ..... is the reduction of soil  $\text{NO}_3$  to  $\text{N}_2\text{O}$ ,  $\text{NO}_2$  and  $\text{N}_2$  that is subsequently released to the atmosphere

(Stolons, Denitrification, Rhizomes, hemi-cellulose, lignin, Anions, Magnesium ions, Hydrogen ions, anions, Warm-season, Endophyte infection)

### Question 6

- a) A farm nutrient balance has components of input and loss. List 2 sources of nitrogen input to a farm (2)
  
- b) List 2 sources of potassium loss from a farm (2)
  
- c) Define soil fertility (2)
  
- d) Write 2-3 sentences on why is soil fertility important (include mention of the main components of soil fertility) (4)

**Question 7**

Defoliation of forages by mowing or grazing reduces the plants carbohydrate reserves.

In 2-3 sentences, why does this occur? (4)

In 2 sentences, what is the significance of this process for determining the timing of late summer and fall harvests of alfalfa? (3)

In 2 sentences, what is the significance of this process for spring alfalfa management? (3)

**Question 8**

Following harvest and once in the silo or bunker, there are 4 main stages involved in silage fermentation. Write 1 sentence (2 sentences for (c) ) describing the approximate duration and main processes during each of the following phases:

a) aerobic (2)

b) lag phase (2)

c) fermentation phase (the key phase – 2 sentences required) (4)

(i)

(ii)

d) stable phase (2)

**Question 9**

(Use the back of this sheet if you need more room for computations)

An alfalfa hay field produces 4 tons/acre/year.

a) If the harvested hay contains 2.2% K, how many pounds of K is removed from an acre in one year? (2)

b) On that same acre, how many pounds of 12-31-20 fertilizer would be required to replace the K lost by crop removal? (4)

c) Three fertilizers have the following characteristics. For each fertilizer, calculate the cost per unit  $K_2O$  (\$/pound  $K_2O$ ) (3)

Fertilizer	% $K_2O$	\$/ton	\$/lb $K_2O$
19-19-19	19%	\$218	a) _____
6-15-40	40%	\$175	b) _____
12-31-20	20%	\$205	c) _____

d) Which fertilizer is the cheapest source of potash? (1)

**Question 10 – Multiple Choice** Circle the correct answer. Each question = 1 point.

8.1: A stolon is:

- a) An underground/burrowing stem
- b) An above-ground/creeping stem
- c) A part of all grass plants
- d) A part of all broadleaf plants

8.2: The Latin name for perennial ryegrass is:

- a) *Lolium multiflorum*
- b) *Lolium hybridum*
- c) *Lolium perenne*
- d) None of these

8.3: Compared to C4 grasses, warm-season (C3) species are:

- a) more tolerant of dry conditions and low carbon dioxide concentrations
- b) less tolerant of dry conditions and low carbon dioxide concentrations
- c) more drought tolerant, but less tolerant of high temperatures (30 C)
- d) less drought tolerant, but more tolerant of high temperatures (30 C)

8.4: The most important reserve for initial growth of forages in early spring is:

- a) stored protein
- b) stored carbohydrates
- c) lignin deposits
- d) soil carbon dioxide

8.5: The most volatile and water soluble nutrient is:

- a)  $\text{NO}_3^-$
- b)  $\text{SO}_4^{2-}$
- c) C
- d)  $\text{Ca}^{+2}$

8.6: One important loss of  $\text{K}^+$  is:

- a) Volatilization
- b) Leaching below the root zone
- c) Adhering to soil particles washed into a waterway
- d) All of the above

8.7: A fertilizer labeled with the specifications 6-15-40 contains:

- a) 40% K
- b) 6%  $\text{NO}_3^-$
- c) 15%  $\text{NH}_4^+$
- d) 15%  $\text{P}_2\text{O}_5$

8.8: Endophyte fungi are found in the following forage species:

- a) All grasses but no legumes have them
- b) Kentucky bluegrass and tall fescue
- c) Ryegrass and tall fescue
- d) Orchardgrass, alfalfa, and ryegrass

8.9: Crimping and other forage conditioning systems help improve hay quality by:

- a) allowing carbohydrates to be released
- b) allowing faster drying of the harvested crop
- c) preventing protein degradation
- d) making baling easier

8.10: BG34 is a common variety of:

- a) white clover
- b) crimson clover
- c) perennial ryegrass
- d) tall fescue

**Question 11**

A productive legume can fix 200 lbN/acre/yr.

- a) name 3 legume species that can fix this amount of N (3)
  
- b) nitrogen is fixed by a symbiotic association with which bacteria? (1)
  
- c) how much urea would need to be applied to equal this rate of N fixation? (2) (urea = 46-0-0)
  
- d) What would this cost if it had to be applied as fertilizer? (2) (urea = \$186/ton)
  
- e) Urea application suppresses nitrogen fixation by 1 lb N-fixed/2 lb of fert-N. If a farmer applied 100 lbN/acre/year, what would the resultant rate of nitrogen fixation? (2)

**Question 12**

- a) What is endophyte? (2)
  
- b) Name one forage species that can be infected with endophyte (1)
  
- c) Name one forage species that does not have endophyte (1)
  
- d) What are two animal symptoms of endophyte toxicity? (2)
  
- e) Currently there is an emphasis to have endophyte-free forage. What are two sources of contamination in “clean” forage. (2)
  
- f) What are novel (non-toxic) endophytes? (2)