TECHNICAL NOTE

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

CHAMPAIGN, ILLINOIS

Grazing Lands Technical Note No. 1

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Subject: Planning and Managing a Prescribed Grazing System

Introduction: There is both an art and a science to effective pasture utilization for the purpose of livestock production. Properly planned and managed pastures provide an effective and efficient food source for the production of meat, milk, and animal fiber.

A well-managed pasture grazing system can significantly improve the carrying capacity and quality of a given unit of pasture. In addition, effective pasture utilization can significantly reduce the cost of livestock production systems by reducing capital costs (machinery and buildings) and variable costs (annual crop establishment and harvesting).

The grazing system should provide quality forage during the entire year or feeding period. The art and science of effective pasture utilization is the selection of the proper forage types, proper stocking rates, fertility program, and the proper timing of grazing (harvests) and rest periods for the forage species. Livestock gains and production will be directly proportional to the ups and downs in forage quality and quantity.

The purpose of the note is to provide the technical guidance on how to plan, layout, and manage a prescribed grazing system, planned grazing system, or management intensive grazing system. The technical note is divided into two parts. Part I provides technical information on grazing and forage fundamentals. Part II focuses on how to plan and layout an effective grazing system.

PART I FORAGE AND GRAZING FUNDAMENTALS

Effective grazing systems involves understanding of (1) the nutritional needs of the grazing animals; (2) the animals grazing habits; (3) vegetative characteristics of grasses, legumes, and browse used for feed; and (4) the nutritional characteristics of the grasses, legumes, and browse used for grazing.

1. Nutritional Needs of Livestock

Ruminant livestock can be raised and maintained on a 100% forage diet. The exception being corn-fed beef. Generally, grain is only needed as a substitute for quality forage or to remedy a poor forage management program.

A general “rule-of-thumb” is to plan 30 to 35 pounds of hay equivalent per day per “animal unit”. The Grassland Spatial Analysis Tool (GSAT) calculates demand based on 26 pounds per day of oven dried forage as a yearly average of consumption for an “animal unit”. An “animal unit” is the equivalent of approximately one, 1000 pound cow with a calf up to 3 months of age, in feed consumption; one 1000 pound dairy or beef cow, two 500 pound heifers or two 500 pound beef steers, five ewes, six sows, or seven goats. A horse usually averages 1.25 animal units, while a bull will average 1.35 animal units. Example: a 1300 pound dairy cow would be 1.3 animal units (1300/1000 = 1.3) or a 700 pound heifer would be .7 animal units (700/1000 = .7). This planning figure is only a “rule-of-thumb”. The actual forage requirement will vary considerably based on the quality of the forage, biological state of the grazing animal, climatic conditions, and time of the year.

For example, if pastures are rotated every 1-3 days compared to every 10-20 days the actual harvest (grazing) will be more efficient. More quality forage will be consumed by using a given stocking rate that will utilize the available forage in 1-3 days on a smaller area than would be utilized by grazing a similar number of stock on a larger area for a longer period of time. *Improved “harvest efficiency” is one of the major advantages of management intensive grazing.* In other words, the actual tons of forage produced per acre may not increase significantly with the higher level of management; but the utilization and carrying capacity may increase significantly due to higher quality forage being consumed and better harvest efficiency.

Other nutritional factors to consider in planning include:

a. A dairy cow or beef cow in peak milk production will have a higher nutritional requirement than a cow nearing the end of her lactation. Priority of the highest quality forage should go to the cows in peak milk production. Lower quality can go to cows nearing the end of their lactation or dry cows. One might consider dividing cattle into groups by nutritional needs. For example, when grazing a given pasture unit for 2 days, the lactating cows may graze the pasture the first day and the dry cows and heifers may graze on the second day.

b. In a beef cow/calf operation the nutritional requirement for the cow is highest the first 60-75 days after calving. After that the nutritional demands of the cow begin to decrease; but the calf will begin to consume more forage. Until weaning, the

combined forage/nutritional needs of the cow and calf together, will remain fairly constant.

c. Cattle and sheep, during their period of rapid weight gain, should be given priority to the higher quality forage to reach their production potential. For example, when grazing a pasture unit for 2 days, the weaned heifers and steers would graze the pasture unit on the first day and get the higher quality forage, and the dry cows would graze the pasture unit the second day consuming the lower quality forage.

d. Forages grazed or harvested during the grazing and hay cutting periods shown on the "grazing and Hay Cutting Guide" will produce optimal yields and quality (nutritional value).

e. Beef cattle biology dictates the priority that nutrients will be utilized. The priorities, with or without adequate nutrition available are (1) maintenance, (2) growth, (3) milk production, and (4) reproduction. Therefore, if nutritional requirements are not being met to supply ample milk production, reproduction will not be successful.

2. Livestock Grazing Habits

Understanding the grazing habits of livestock will assist in the management of the livestock and pastures to maximize production and avoid overgrazing and low forage quality.

a. Given the opportunity, livestock will eat (harvest) the most succulent forage first and eat the less desirable last. This habit will be observed when livestock are given a relatively large area to graze for a length of time. The preferred species will be grazed and regrazed, often times severely damaging the most desirable forage, and allow the less desirable/lower value forages to take over a pasture.

   By limiting the size of a grazing area to that which can be completely grazed in 1-5 days will force livestock to eat all the forage and maintain a more productive and higher quality diet. *The fewer days the better.*

b. Livestock generally travel to water twice a day. If water supply points are limited, spots of over grazing and nitrogen loading will probably result. *Try to develop multiple water points to promote more uniform grazing. If possible, keep waterings no further than 600 to 800 feet from livestock.*

c. Livestock tend to go to salt and mineral blocks once a day. Since 4-8 hours generally elapse between consuming salt and drinking water, salt and mineral blocks should be located away from the water source and put in an area of lighter grazing to encourage more uniform grazing.

d. Livestock tend to graze areas that are more level. As the steepness of a pasture area increases it is more critical to limit the pasture size to encourage uniform grazing without causing erosion.

3. Vegetative Characteristics of Grasses and Legumes

– Cool Season Grasses - Grasses that begin their growth early in the spring when soil temperatures reach 40-45 degrees (F) and complete their life cycle in the cooler months before hot summer weather. Cool season grasses provide valuable sources

of forage during spring, late summer, fall, and in some cases early winter. Common pasture species include: Orchardgrass, timothy, smooth brome, bluegrass, and perennial ryegrass. Peak production for most cool season grasses occurs in May and June in Illinois.

- Warm Season Grasses - Grasses that begin their surge of growth when soil temperatures reach 60-65 degrees and complete their life cycle during the summer. Warm season grasses provide an important source of forage in mid-to-late June through August in Illinois. Common pasture species include switchgrass, big bluestem, eastern Gamagrass, and Indiangrass.

- Legumes - Plants that have symbiotic bacteria responsible for the formation of the nodules on the roots that can assimilate nitrogen from the air and make it available to the plant. Common forage legumes include alfalfa, red clover, birdsfoot trefoil, alsike clover, and ladino clover. Peak production for legumes occurs in May, June, and early July; however, alfalfa has the capability to maintain good production throughout the growing season.

- Jointed grasses such as smooth brome, timothy, and reed canary have the growing point inside the stem near the soil surface when growth begins in the spring. The growing point stays above the upper joint as the plant grows and each leaf develops from the growing point. After all the leaves are formed the growing point forms a seed head. The enlargement of the seed head in the upper part of the plant is called the “boot stage”. If the growing point is removed after the boot stage (but before seed head emergence) a regrowth mechanism is triggered resulting in a rapid regrowth or tillers from the basal nodes. If the jointed grasses are allowed to completely head out before grazing or cutting, regrowth will be very limited. Therefore, jointed grasses (timothy and smooth brome) should be harvested/grazed prior to seed head emergence to insure better regrowth and maximize forage quality.

- Nonjointed Grasses such as bluegrass, orchardgrass, and fescues have a growing point near the soil surface throughout the growing season. The growing point is fairly well protected from grazing or cutting. Leaves develop from these lower growing points. These grasses are generally better suited to shorter grazing heights and should be grazed or cut earlier than jointed grasses. These grasses can generally withstand longer and more intense grazing than jointed grasses. <u>However</u>, it is still critical to observe the necessary rest periods to maintain plant food reserves in the roots and maintain sufficient leaf area for photosynthesis.

- The legume growing point is located at the end of the stems and branches. Regrowth after grazing or cutting is from the crown or lateral buds. For legumes, such as alfalfa with weak lateral buds it is best to graze or cut alfalfa as close to the crown as possible without damaging the crown, allowing the crown bud to start a new and more productive regrowth. The alfalfa stems closest to the ground are less palatable and digestible. Therefore, livestock should be grouped or stocked at a rate to force the grazing of the lower stem. If the lower stems are not cut of grazed regrowth will be from the less productive lateral buds.

- Plant Food Reserves. Grasses and legumes must maintain adequate food reserves in the stems and roots to reach their production potential and maintain themselves.

By following the recommended grazing periods and rest period shown in the "Grazing and Hay Cutting Guide" adequate plant food reserves can be maintained.

- Cool season grasses and legumes generally store most of their food reserves in their roots and crowns. Rest periods and maintaining sufficient leaf area are critical elements to maintain adequate root reserves for growth.

- Warm season grasses store their food reserves not only in their root systems but also store a significant amount of reserves in lower portion of their stems (6-8 inches above the soil surface). Therefore, the primary reason warm season grasses should be grazed or cut no lower than 6 inches and preferably not lower than 8 inches. Closer grazing or cutting will severely limit or slow regrowth and jeopardize the survival of the stand.

- Because forage regrowth is contingent upon root reserves, above ground plant reserves, and photosynthesis, managing both the plant roots and leaf surface area is critical. The general rule-of-thumb is TAKE HALF AND LEAVE HALF. The following chart illustrates how grazing affects root growth stoppage.

Percent Leaf Volume Removed[2]	**Percent Root Growth Stoppage**	
10%	0%	
20%	0%	
30%	0%	
40%	0%	
50%	2-4%	Critical point (leave half)
60%	50%	
70%	78%	
80%	100%	At this point root growth is stopped for 12-18 days
90%	100%	

NOTE: When up to half the leaves of a grass plant are grazed off, the root growth continues unimpaired. However, when an additional 10% is harvested (60% removed), half the root growth is stopped. At 80% of the plant removal, root growth stops completely--and at least 30% is needed annually to replace roots naturally pruned. Removing 80% of the leaves also stops root growth for 12 days. Taking off 90 percent of the leaves stops root growth completely for 18 days.

NOTE: The stage to start grazing and the stage to remove livestock (See Table 2) very closely matches the rule-of-thumb: TAKE HALF AND LEAVE HALF. Combined with the appropriate rest periods recommended will assure productive and quality forage.

4. Nutritional Characteristics of Grasses and Legumes

Overall forage quality is influenced more by soil fertility and grazing at the proper stage than the particular species of forage. The better an operator can manage the pasture throughout the season to promote uniform grazing and grazing at the proper time the higher will be the forage/pasture quality and production. Management Intensive Grazing can significantly improve pasture quality and quantity.

The following table “Quality Grades for Forages” illustrates how the quality of forage decreases according to condition and maturity.

QUALITY GRADES FOR FORAGES

GRADE	DESCRIPTION	Chemical Composition		
		CP	ADF	NDF
		Percent of Dry Matter		
Prime	**Legume, prebloom, leafy, green**	**19**	**30**	**39**
1	**Leafy. Green**			
	Legume-early bloom	17-19	31-35	40-46
	Grass Vegetative	18	33	55
	Mix-less than 20% grass	17-19	31-35	44-50
2	**Leafy, light green to green**			
	Legume-midbloom (half the plant in bloom)		14-16	36-40
	Grass-early head	13-18	33-38	55-60
	Mix-less than 30% grass	14-16	36-40	50-55
3	**Stemmy. light to yellow green**			
	Legume-full bloom (most plants in bloom)	11-13	40-42	53-60
	Grass-head (milk to dough)	10-12	39-41	61-65
	Mix-less than 40% grass	10-12	39-41	55-62
4	**Predominantly stems, brown to green**			
	Legume-full bloom (all plants in bloom)	8-10	43-45	61-65
	Grass-head (dough)	8-10	43-45	61-65
	Mix-less than 50% grass	8-10	43-45	61-65
5	Mostly grass in late head, brown to green less than 20% moisture	<8	>46	>65

CP = Crude Protein; NDF = Neutral Detergent Fiber; ADF = Acid Detergent Fiber; < less than; > more than.

The “Quality Grades for Forage” table illustrates how forage quality drops the older (more mature) the given forage gets. By following the recommended grazing periods shown on the “Grazing and Hay Cutting Guide” will help assure that pastures are grazed or cut to get the best mix between quality and quantity of forage.

PART II - PASTURE PLANNING AND LAYOUT GUIDANCE

1. Balance Forage Production (Supply) With Forage Needs (Demand)

Before an effective grazing management plan can be laid out the forage production must be balanced with the forage needs. Balance supply with demand. It is especially critical not to have more forage needs than available forage. If forage needs exceed the available forage, the grazing system will not be successful unless additional feed/forage is provided in a feedlot, which will substantially increase the cost of feeding livestock.

The Grassland Spatial Analysis Tool (GSAT) computer program can be used to balance expected forage production with the expected forage needs. Forage production and needs are balanced by estimating dry matter production (in lbs/ac) for each forage species or pasture area multiplied by the acres of each. Add together estimated production from all areas. The result will be the total dry matter in pounds for the entire forage system. Divide the total pounds of forage dry matter by 12,000 pounds (the amount of dry matter each 1000-lb animal unit will require each year). The result will be the number of 1000-lb animal units the forage systems will initially support.

EXAMPLE: A forage system has 40 acres of bluegrass with an estimated production of 5000 lbs/ac dry matter per year and 40 acres of orchardgrass with an estimated dry matter production of 8000 lbs/ac. How many 1000 lb animal units will this system support?
a. 40 ac Bluegrass X 5000 lbs/ac = 200,000 lbs dry matter
b. 40 ac Orchardgrass X 8000 lbs/ac 320,000 lbs dry matter
c. 200,000 + 320,000 Total Dry Matter Produced = 520,000 lbs
d. 520,000 lbs DM / 12,000 lbs DM per 1000 lb AU = 43 AU's

Therefore, one can estimate that the above forage system should be capable of initially supporting 43 (1000 lb) animal units on a year round basis.

The above should be a starting point, following the inventory of the operation. As a producer moves from a continuous grazing system, or a system of 2-4 grazing areas, to a more intensive management of 8 or more grazing areas the carrying capacity should increase. Generally, as the number of pastures is increased the carrying capacity will increase for the total system. The increase is due to some increase in production, but primarily through improved harvest/grazing efficiency and the livestock consuming higher quality forage. By pasturing the higher quality forage, or feeding higher quality hay, carrying capacity for the total system can be increased with good management. As experience is gained on an individual operation, animal units can be adjusted to better utilize available forage.

2. Divide Livestock into Groups

The efficiency of a pasture system can be improved by dividing livestock into different groups based on nutritional requirements. Different groups will allow those animals with the

highest nutritional requirements to consume the highest quality forage and the livestock with the lower requirements can consume the lower quality of forage.

The groups can be grazed sequentially in the same pasture by grazing the high producers first on the high quality forage followed by the low producers on the lower quality forage; OR, the high producers can be put in the highest quality pastures and the low producers put in the lower quality pastures.

The following table divides livestock groups by nutritional needs.

GRAZING GROUPS BASED ON NUTRITIONAL NEEDS [1]			
	High Needs	**Moderate Needs**	**Lower Needs**
Dairy	Lactating Cows	Heifers	Dry Cows
Beef	Steers & Heifers for meat production	Cows w/Calves Growing Heifers	Dry Cows
Goats	Milking Does	Does w/Kids	Dry Does
Sheep	Weaned Lambs	Ewes w/Lambs	Dry Ewes

3. Determine the Maximum Rest Period in Days

For most pasture (forage) species in Illinois, plan a maximum 36-day rest period. Although as little as 18 days of rest is sufficient in the spring for many forages, most forages need approximately 36 days of rest during the summer months. See "**TABLE 1:** Grazing Management Guidelines" to determine the maximum rest period.

4. Determine the Grazing Period

Grasses and legumes should generally be grazed no longer than 6 days. After 6 days livestock will begin to eat the lush regrowth that can severely draw down the plant's root reserves and either reduce production or damage the plant. Leaving the livestock in a pasture or paddock longer than 6 days; also, encourages more selectivity among plants eaten, which reduces the harvesting efficiency by leaving more forage ungrazed. Generally, a 2-3 day grazing period is very efficient for most operations.

5. Determine the Number/Size of Paddocks Needed

The number of paddocks needed can be determined by using the following formula:

No. of Pastures =	Maximum Rest Period (days) / Grazing Period (days)	+ No. Groups
Example:	• Maximum Rest Period is 36 days • Grazing Period is 3 days • Number of Grazing Groups is 2	
No of Pastures =	36 day rest period / 3 day grazing period	+ **2 groups**
	No of Pastures = 14	

6. Guidelines for a Pasture Layout

a. Try to minimize the amount of permanent fences required to reduce cost and maintain maximum flexibility. Planning permanent fences along property lines, dividing areas of land use (Ex. pastureland and woodland), along roads, and major watercourses is usually best. Try to use temporary fences as much as possible within the pastureland, which will hold down capital investment and maintain more flexibility as to the size and number of pasture paddocks at any given time.

b. Try to keep a source of water within 1/4 mile of a pasture. Ideally water should be available in each of the pastures, as they are being grazed and no further than 800 foot from any part of the pasture. Water availability can be accomplished by installing underground pipelines or temporary above ground hoses connected to a source of water (spring development, pond, and well). Water can also be made available in adjacent watercourses by construction of “water access points”. Water can also be hauled in tanks and made available in each pasture. Livestock perform better when they have access to clean high quality water. Every effort should be made to ensure livestock receive quality water.

c. Try to keep pastures as square as possible. Square pastures minimize the amount of fence required and generally facilitate more even grazing.

d. Livestock prefer to walk and graze on the contour. Avoid laying out narrow pastures going up and down the slope.

7. Planning the Grazing and Rest Period Schedule.

Refer to the Prescribed Grazing Standard (Practice Code 528) in Section IV of the FOTG at

http://efotg.sc.egov.usda.gov//references/public/IL/528.pdf

References:

1. Wisconsin Pastures for Profit (A3529), May 1991

2. GRASS: A Stockman's Crop, How to Harvest More of It, Harland Dietz, SCS (retired) 1989

TABLE 1: Grazing Management Guidelines.

Pasture Kind	Min-Max Grazing Periods (days) 1/	Min-Max Rest Periods (days) 2/	Minimum Pastures Needed (number) 3/
Single Species - 1 specie planting (essentially a monoculture)			
Introduced:			
cool season	10 - 22	20 - 45	3
warm-season	10 - 22	20 - 45	3
legume	6 - 9	25 - 35	5
Native:			
warm-season	1 - 17	20 - 50	4
Simple Mixtures - 2 - 4 similar species and/or legumes			
Introduced:			
cool-season	8 - 15	25 - 45	4
warm-season	8 - 15	25 - 45	4
Native:			
warm-season	8 - 12	30 - 50	5
Complex Mixtures - 5 or more dissimilar species			
Introduced:			
cool-season	5 - 9	25 - 45	6
warm-season	5 - 9	25 - 45	6
Native			
warm-season	4 - 7	30 - 50	8

1/ “Min-Max Grazing Periods" are determined by the Min-Max Rest Period necessary for adequate recovery of the pasture following grazing, and also limits second bite opportunity. However, second bites occur if livestock are left in a pasture longer than 6 or 7 days.
2/ “Min-Max Rest Periods" provide time for pastures to recover from grazing. The pasture's potential growth rate and current growing conditions regulate the length of the rest period. (Rapid growth, rapid rotation - slow growth, slow rotation.
3/ “Minimum Pastures Needed" is a relationship between necessary rest period and appropriate grazing period. Increasing pasture numbers, reduces length of grazing period, increases pasture rest, improves harvest efficiency, and provides higher forage quality.

TABLE 2: Minimum Heights of Pasture Species for Initiating and Terminating Grazing

SPECIES AND MIXTURES	**Minimum/Optimum Height of Vegetative Growth 1/**	**Minimum Grazing Height 2/**	**Minimum Regrowth Before Killing Frost**	**Approximate Date to Begin Rest for Winter protection, by Plant Suitability Zones 3/**		
COOL SEASON (C3s)	INCHES Begin Grazing	INCHES End Grazing	INCHES	I	II	III
Alfalfa/Timothy/Orchardgrass	6 - 8	3	8	9/1 - 10/1	9/15 - 10/15	9/20 - 10/20
Alfalfa/Orchardgrass	6 - 8	3	8	9/1 - 10/1	9/15 - 10/15	9/20 - 10/20
Alfalfa/Timothy/Bromegrass	6 - 8	3	8	9/1 - 10/1	9/15 - 10/15	9/20 - 10/20
Ladino Clover/Orchardgrass	8	3	8	9/1 - 10/1	9/15 - 10/15	9/20 - 10/20
Red Clover/Ladino Clover/Orchardgrass	8	3	8	9/1 - 10/1	9/15 - 10/15	9/20 - 10/20
Red Clover/Ladino Clover/Tall Fescue	8	3	5		9/15 - 10/15	9/20 - 10/20
Birdsfoot Trefoil/Timothy	5	3	6	9/1 - 10/1	9/15 - 10/15	
Ladino Clover/Bromegrass	5	3	6	9/1 - 10/1	9/15 - 10/15	
Orchardgrass	6 - 8	3	8	4/	4/	4/
Tall Fescue	6 - 8	3	8	4/	4/	4/
Alfalfa/Tall Fescue	6 - 8	3	8		9/15 - 10/15	9/20 - 10/20
Ladino Clover/Tall Fescue	5	3	8		9/15 - 10/15	9/20 - 10/20
Alsike Clover/Ladino Clover/Timothy	5	2	5	9/1 - 10/1	9/15 - 10/15	
Ladino Clover/Alsike Clover/Tall Fescue	5	3	8		9/15 - 10/15	9/20 - 10/20
Alfalfa/Bromegrass	6 - 8	4	6	9/1 - 10/1	9/15 - 10/15	9/20 - 10/20
Sericea Lespedeza/Tall Fescue	10	4	8			9/20 - 10/20
Korean Lespedeza/Tall Fescue	6	4	8			9/20 - 10/20
Bluegrass 5/	4	2	4	N/A	N/A	N/A
WARM SEASON (C4s)						
Switchgrass	18	8 6/	10	9/10 - 10/10	9/15 - 10/15	9/20 - 10/20
Indiangrass	18	8 6/	10	9/10 - 10/10	9/15 - 10/15	9/20 - 10/20
Big Bluestem	18	8 6/	10	9/10 - 10/10	9/15 - 10/15	9/20 - 10/20
Eastern Gamagrass	20	10	15	9/10 – 10/10	9/15 – 10/15	9/20 – 10/20

1/ Minimum plant heights are to be reached before grazing is permitted in the spring or following a rest period resulting from rotational grazing. Management Intensive Grazing (MIG) systems (8 or more pastures) can reduce the height by 50%.
2/ Minimum plant heights below which grazing or haying is not recommended.
3/ Protection from fall grazing is required for one month before a killing frost. Remove livestock on or before the dates shown and do not permit grazing before a killing frost occurs.
4/ No restrictions.
5/ May include other species such as redtop, timothy, quackgrass, or white clover.
6/ Leave a 10" stubble at end of grazing season until after first killing frost.

TABLE 3. Estimated Percentage of Annual Growth, Hay Equivalent, and Hay yields per acre for the Growing Season of Selected Pasture Crops under Continuous Grazing Management in Southern Illinois - Plant Suitability Zone I. (Data converted from U of I, College of Ag., Agronomy Facts, F-54 March, 1991, by C. J. (Jim) Kaiser).

Pasture Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tons of H. E.	Tons of Hay
Alfalfa	0	0	3	9	18	18	15	15	12	9	3	0	2.04	3.04
Tall Fescue	0	0	6	15	18	18	7	4	7	13	9	3	2.02	3
Orchardgrass	0	0	3	16	19	16	10	6	10	13	6	0	1.86	2.77
Smooth Bromegrass	0	0	3	16	19	19	10	4	8	13	6	0	1.85	2.75
Red Clover	0	0	4	11	18	19	18	11	7	7	4	0	1.62	2.41
Eastern Gamagrass	0	0	0	0	10	23	25	17	17	8	0	0	1.44	2.15
Bermuda grass	0	0	0	0	7	20	25	25	17	5	0	0	1.42	2.11
Switchgrass	0	0	0	0	19	27	27	14	9	4	0	0	1.32	1.97
Big Bluestem	0	0	0	0	14	28	28	24	5	0	0	0	1.26	1.88
Indiangrass	0	0	0	0	10	15	25	30	15	5	0	0	1.2	1.79
Sorghum-sudangrass	0	0	0	0	0	8	31	31	25	5	0	0	1.18	1.75
Pearl Millet	0	0	0	0	0	5	31	31	26	5	0	0	1.16	1.73
Sericea lespedeza	0	0	0	3	10	20	21	19	16	10	0	0	1.15	1.72
Sweet clover	0	0	3	16	21	21	11	5	5	16	2	0	1.14	1.7
Birdsfoot trefoil	0	0	2	10	22	22	16	10	13	5	0	0	1.13	1.68
Bluegrass	0	0	2	17	28	11	5	3	7	17	8	0	1.06	1.57
Timothy	0	0	3	18	24	24	6	5	7	10	3	0	0.98	1.47
Winter rye	0	0	19	25	0	0	0	0	0	19	25	12	0.96	1.43
White clover	0	0	8	20	20	19	6	3	6	13	5	0	0.92	1.38
Redtop	0	0	0	18	27	27	8	3	8	9	0	0	0.8	1.2
Lespedeza	0	0	0	0	0	11	23	23	23	20	0	0	0.78	1.16
Perennial ryegrass	0	0	0	0	25	33	18	8	8	8	0	0	0.72	1.07
Spring oat	0	0	0	10	45	45	0	0	0	0	0	0	0.66	0.98
Spring rape	0	0	0	0	0	10	30	30	20	10	0	0	0.6	0.89
Fall rape	12	0	0	0	0	0	0	0	0	13	38	37	0.48	0.72

Adjust annual production, by months, by approximately 15 and 20 days for Plant Suitability Zones II and III, respectively.

Tons of H. E. = Tons of Hay Equivalent