NC STATE UNIVERSITY

CEFS
CENTER for ENVIRONMENTAL FARMING SYSTEMS
NCSU | NCA&TSU | NCDA&CS
www.cefs.ncsu.edu

In the search of an ecofriendly Pastured pork production system

Lessons learned at CEFS

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June 2015

Potential Environmental impact of Outdoor Hog Production

Animal activities

- Grazing , Rooting
- Trampling, Wallowing
- Dunging areas

Ground cover destruction
Soil compaction
Nutrients upload

Run off
Erosion
Environmental pollution


Animal Welfare?
Environmentally Friendly?

Role of forages in pastured pork operations

Vegetative ground cover: Trampling and rooting resistance : Tall fescue, KY bluegrass, Bermudagrass, Bahiagrass

Source of nutrients: good quality, high digestibility , low in fiber, leaves:stems ratio. Alfalfa, White and red clover, Smallgrains, Ryegrass, Brassicas, Sudangrass, Millet, Crabgrass

Grazed vegetation, supplementary feed hay, silage or root crops

Pastures for swine

Grass, legumes, grass + legumes, herbs
Roots
Grain
Orchards
Forests

Need to be complemented with protein and Energy

Pastures for hogs

Permanent pasture perennials: bluegrass, white clover, Bermuda-grass, carpetgrass, Tall Fescue, and Dallisgrass

Rotation pastures: alfalfa, red clover, Ladino, sweet clover, alsike, orchardgrass, bromegrass, and lespedeza.

Temporary pastures: rape, soybeans, cowpeas, Sudangrass, rye, oats, wheat, barley, Italian ryegrass, and field peas. Heavier rate of seeding.

Mixed grass pastures: Alfalfa, Ladino clover, alsike, bromegrass and orchardgrass.

Hogged-down crops: corn, sorghums, sweet potatoes, peanuts, and small grain


Cachorros Pampa Rocha
Mixed pastures for hogs
Unidad de Producción de Cerdos
www.fagro.edu.uy/upc
www.upc.edu.uy/upc/galeria

Plant with potential for pastured pork operations

Bermudagrass (*Cynodon dactylon*)
Chicory (*Cichorium intybus*)
Jerusalem artichoke (*Solanum tuberosum*)
Star grass (*Cynodon nlemfuensis*)
Brachiarias

Poisonous plants

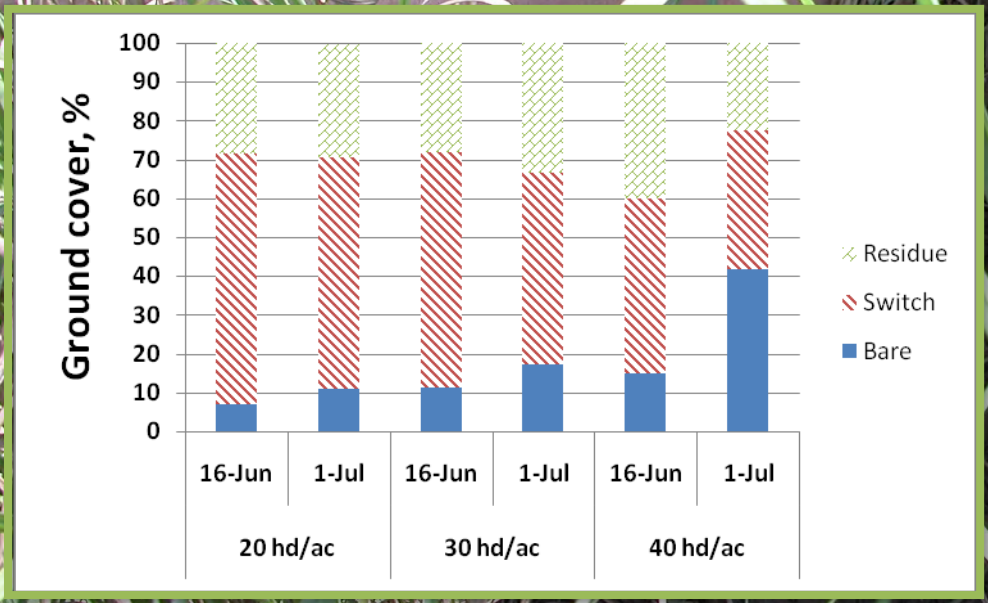
Ragwort (*Senecio jacobaea* L.; *Jacobaea vulgaris*)
Thistle (*Onopordum acanthium*)
Pigweed (*Amaranthus* spp.)
Hemlock *(Conium maculatum)*
Showy rattlebox (*Crotalaria spectabilis)*
Corncockle (*Agrostemma githago*)
Lenten rose *(Helleborus spp*.)

Toxicity level: vegetative stage, intake and animal physiological status.

Ferrari 2001, Parisini *et al*. 2003

Switchgrass

20, 30 and 40 head/acre (6000, 9000 and 12000 lb/ac, respectively)



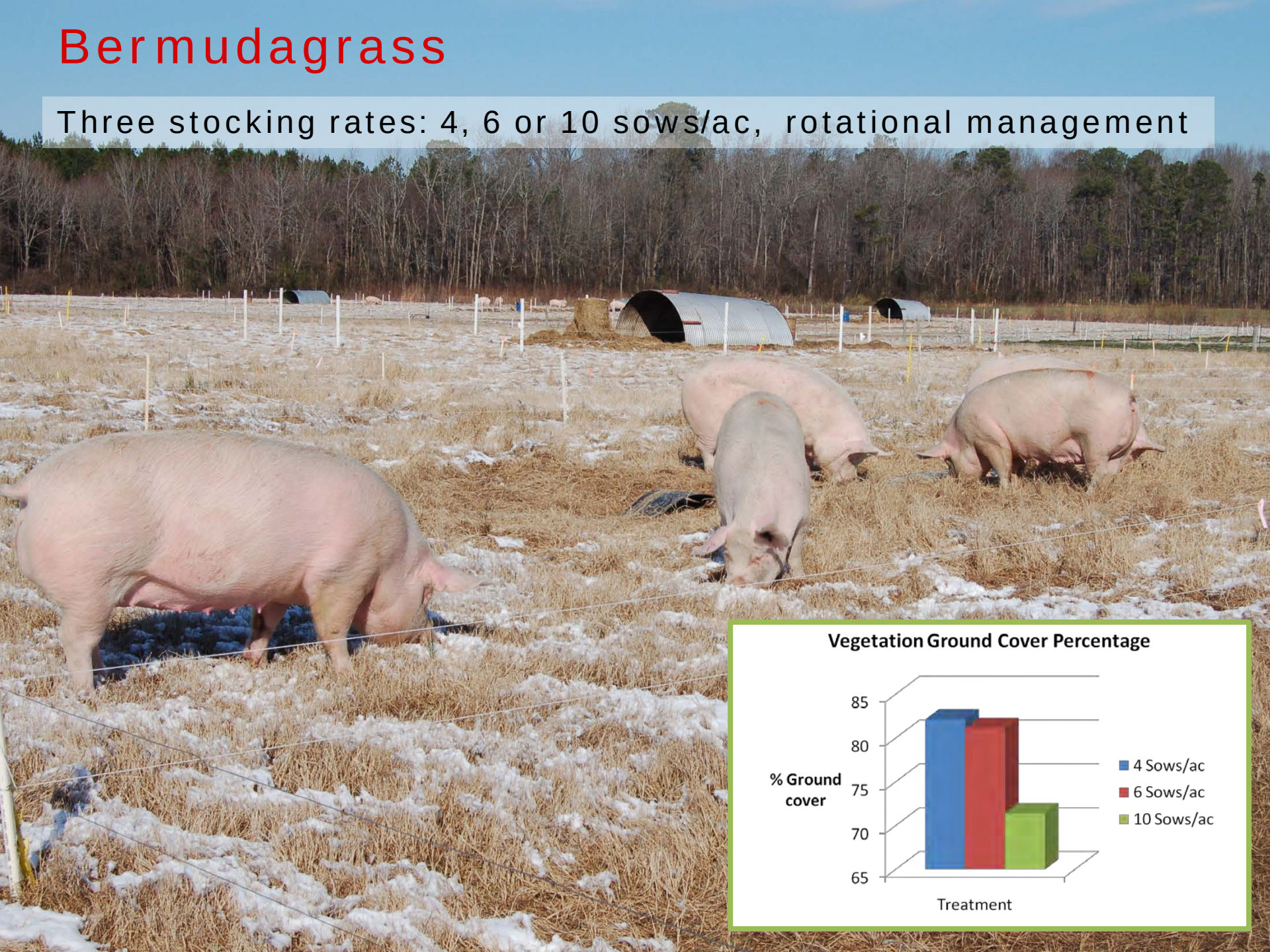
Final ground cover* (%) in bermudagrass paddocks managed with different stocking rates in a continuous system during a 12-week finishing period.

60 pigs/ac
2 batches of pigs
90 d of utilization/batch of pigs

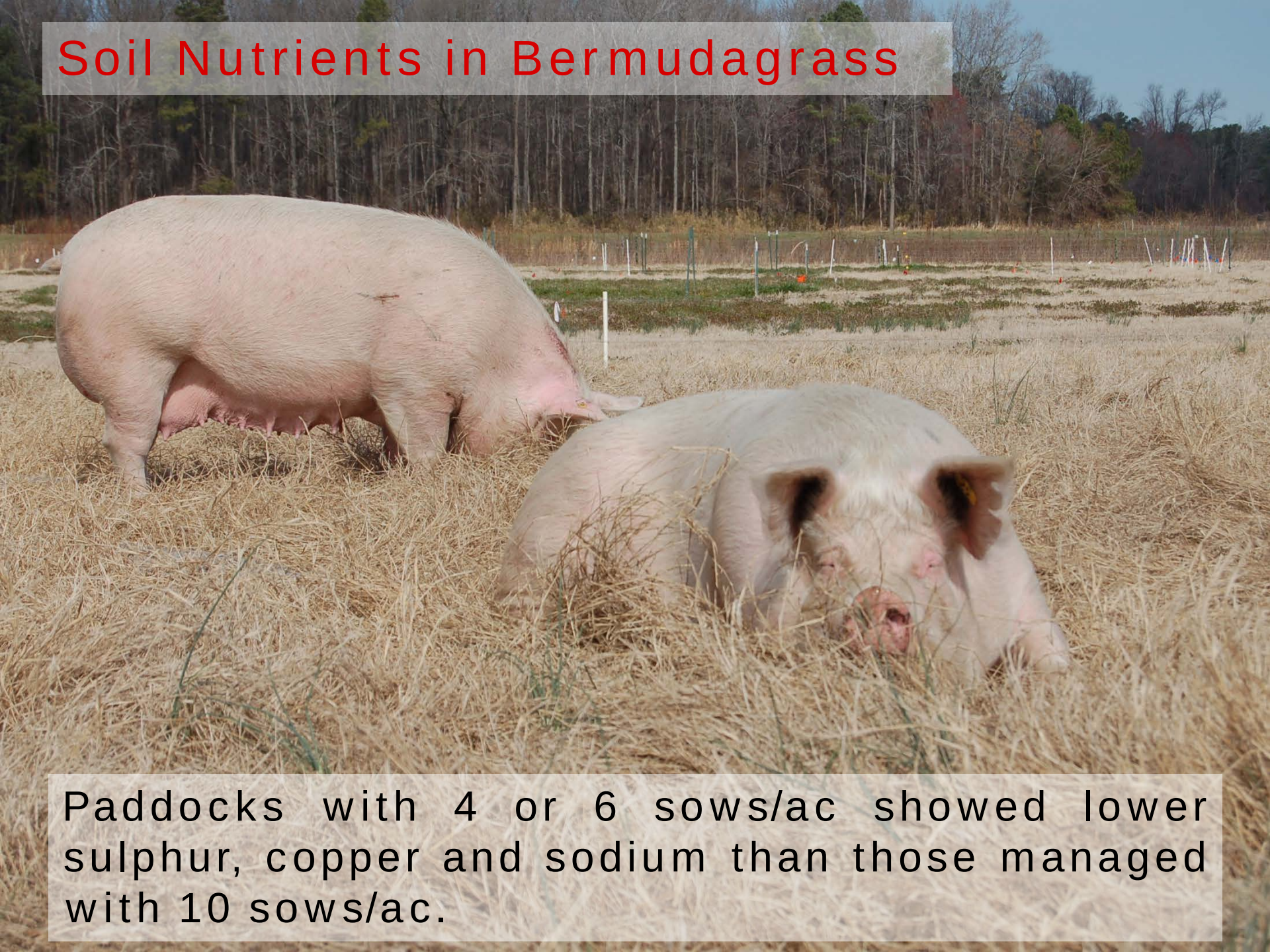
15 pigs/ac
2 batches of pigs
90 d of utilization/batch of pigs

Bermudagrass

Three stocking rates: 4, 6 or 10 sows/ac, rotational management



Soil Nutrients in Bermudagrass



Paddocks with 4 or 6 sows/ac showed lower sulphur, copper and sodium than those managed with 10 sows/ac.

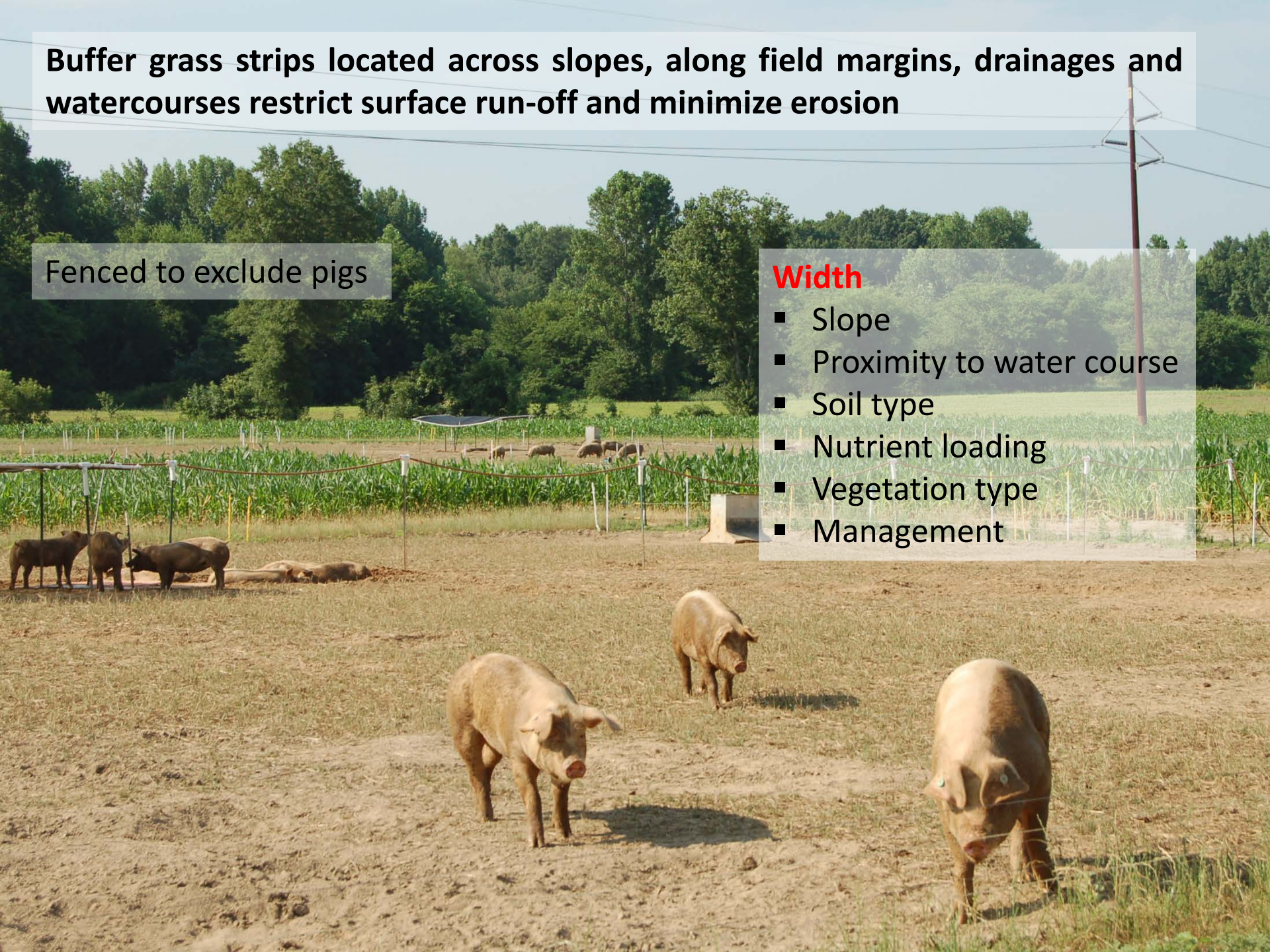

Annual forage species are more sensitive to animal damage
Sudangrass with 30 pigs/ac for 12 weeks

Approximate stocking rates to maintain vegetation cover for rangeland and pastures in the San Francisco bay area

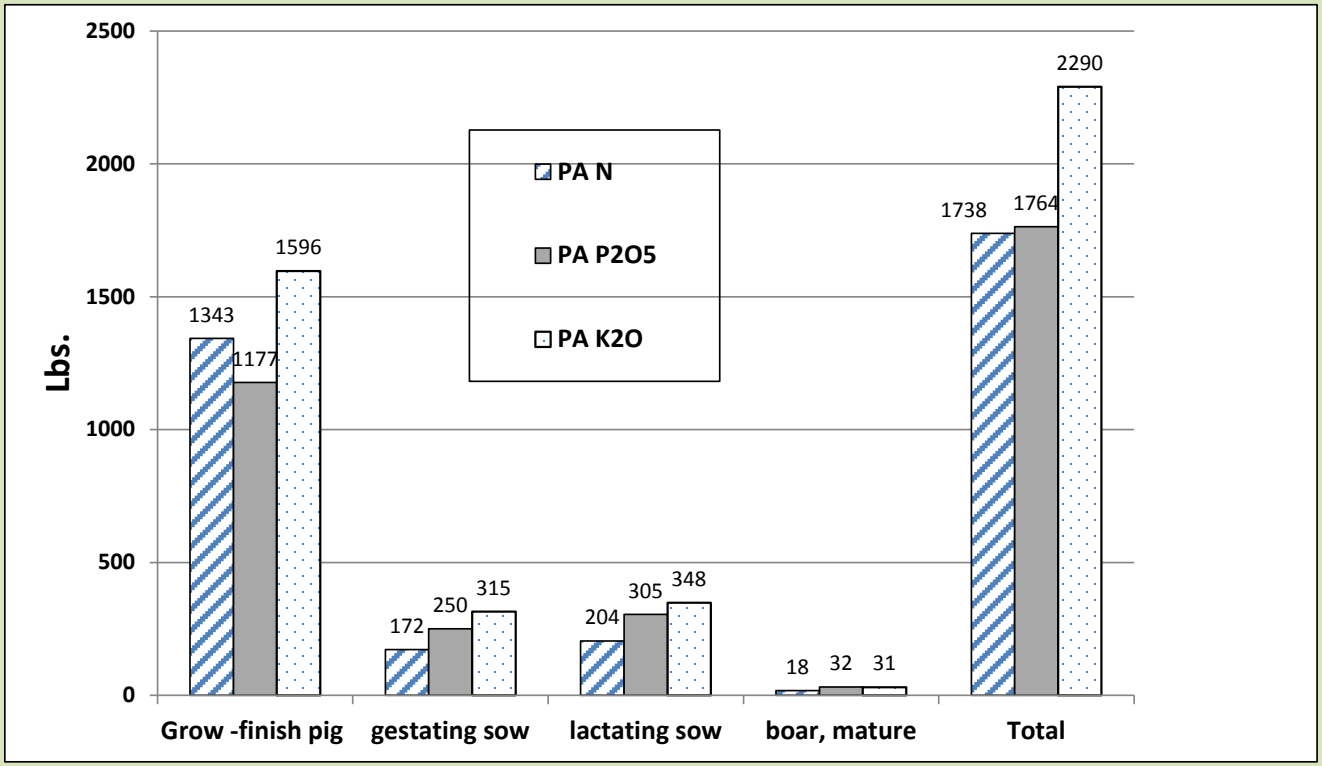
Annual species *10 to 20 weaned to finishing head/ac
* 2 to 4 sows + litter/ac

Perennial species * 15 to 30 weaned to finishing head/ac
* 4 to 6 sows + litter/ac

Natural vegetation * 4 to 10 weaned to finishing head/ac
* 0.5 to 1 sows + litter/ac


Buffer grass strips located across slopes, along field margins, drainages and watercourses restrict surface run-off and minimize erosion
Fenced to exclude pigs
Width
Slope
Proximity to water course
Soil type
Nutrient loading
Vegetation type
Management

Nutrient loading for farrow to finish operation



PA: plant available

24 sows weaning 14 pigs (7 pigs/farrowing) and 2 boars

Value of nutrients based on the data presented in the figure above.

Commercial fertilizer prices, Nov 2013

Fertilizer	$/ton	P $ - N$	$/lb
Urea 45-0	$ 484		$ 0.54
18-46-0	$ 470	$ 276	$ 0.30
0-0-60	$ 475		$ 0.40

Nutrients produced and $ value based on figure above

Nutrient	lbs	$ value
PA N	1738	**$ 935**
PA P2O5	1764	**$ 530**
PA K2O	2290	**$ 907**
Total		**$ 2,371**

Removal of nutrients deposited

A cereal rye + annual ryegrass mixture, followed by forage sorghum has shown to effectively remove soil nutrients deposited by hogs.

Soil nutrients were lowered to levels similar to those recorded before having pigs on the paddocks .

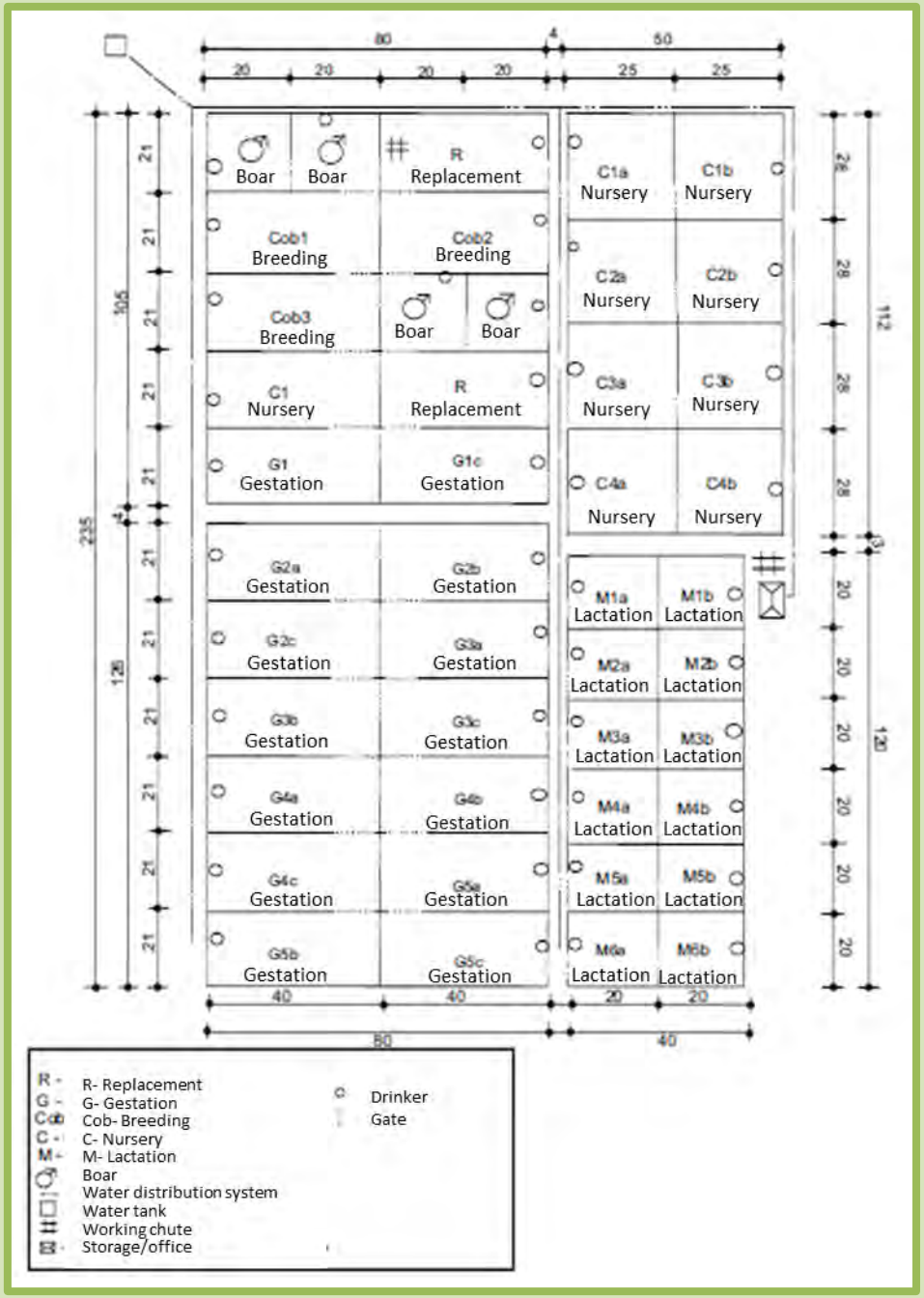
Renner and others 2011

Layout SISCAL-EMBRAPA

Farrow to wean operation

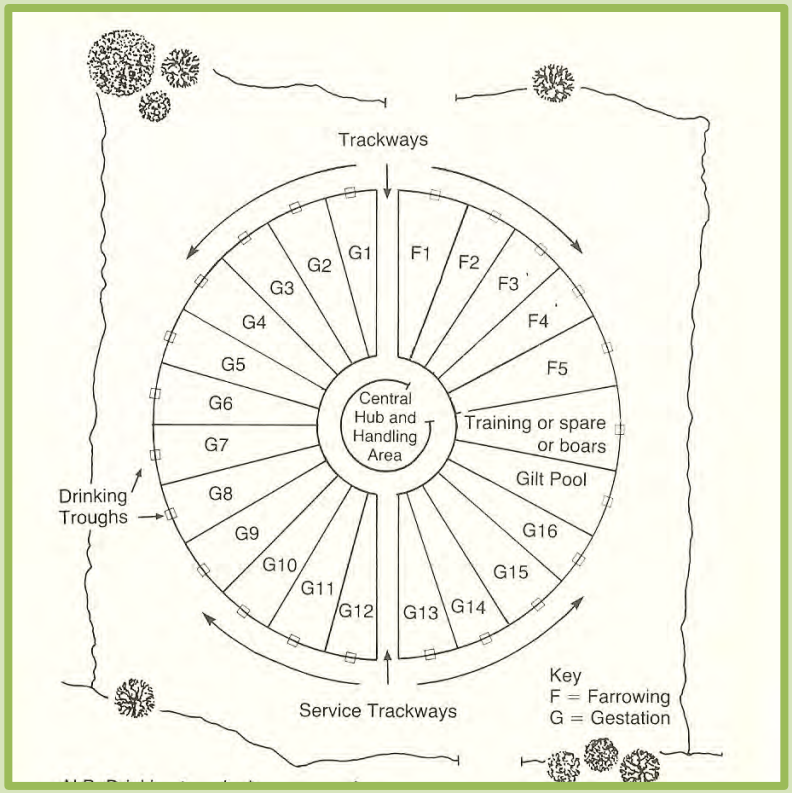
Area 7 ac
23 sows (7 groups [5 x 3] + [2 x 4])
2 boars
Weaning age 28 days
Nursery, from weaning to 48 lb
Replacement 2 paddocks

	Paddocks		
	N	Dimensions ft	Area ft^2
Breeding	3	69x131	9042
Gestation	14	69x131	9042
Lactation	12	66X66	4306
Nursery	8	82x92	7535
Boar	4	66x69	4521
Replacement	2	131x69	9042



Dalla Costa *et al*. 2001

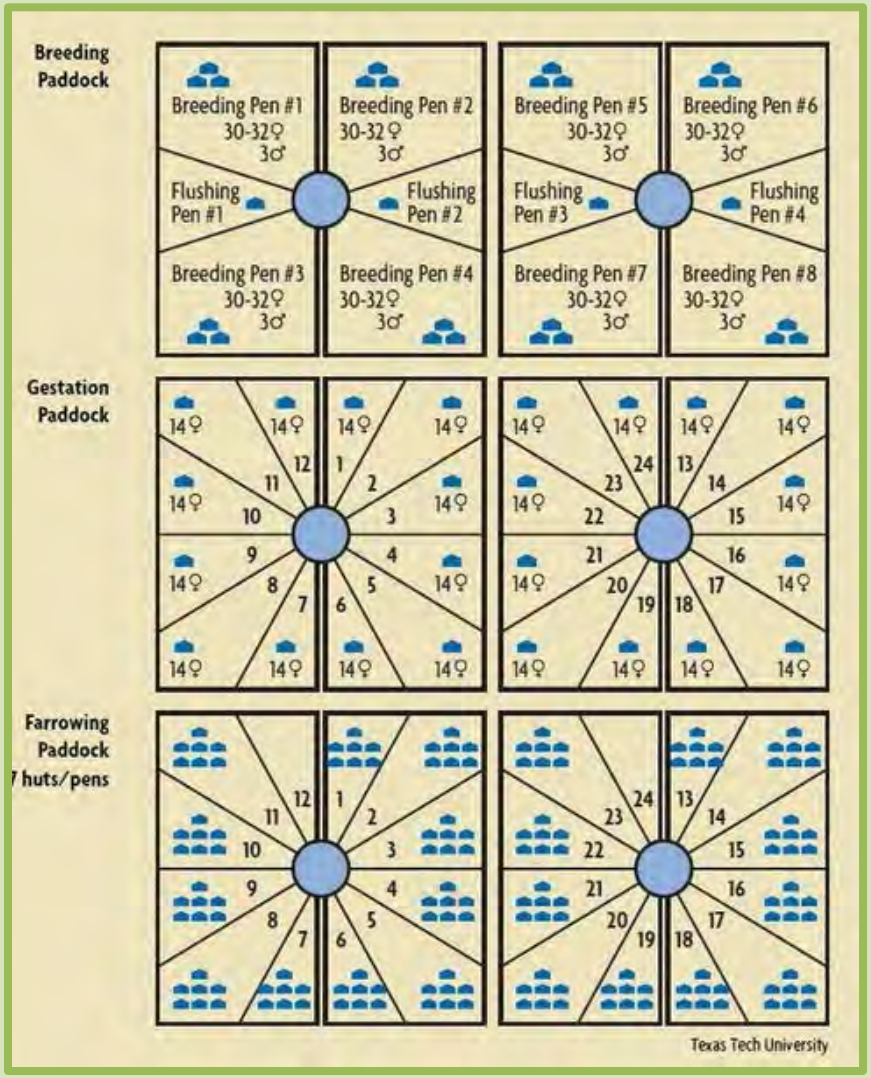
Radial paddock layout, 240 sows



Total area 37-47 ac

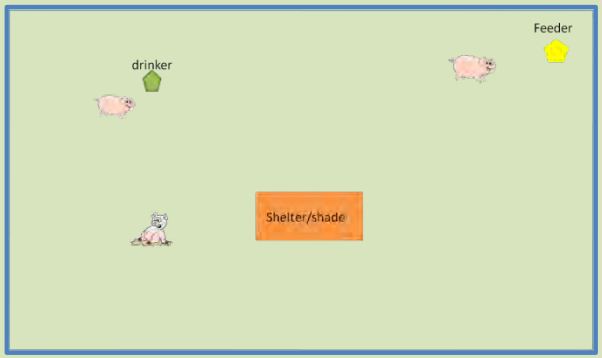
Keith Thornton , 1990

Texas tech University, 600 sows

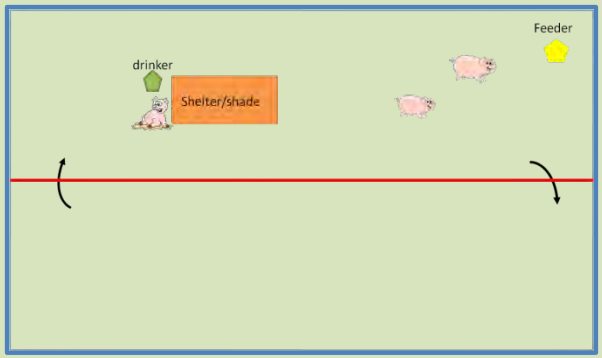


http://www.porktexas.com/what-is-pork-texas.html

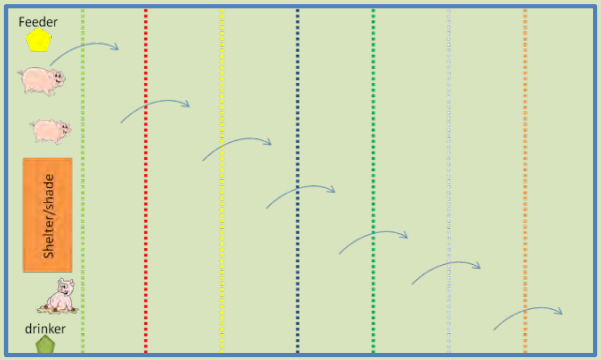
How Implement rotations



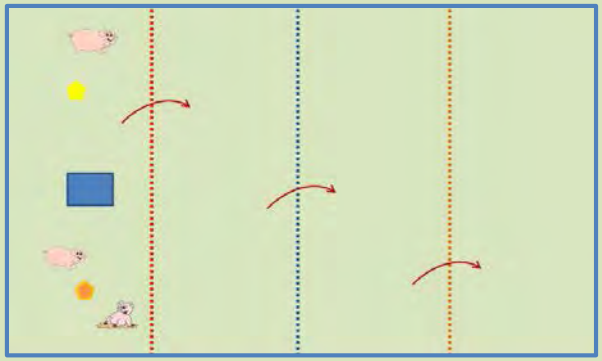
Continuous system
Periodic movement of feeder and drinkers



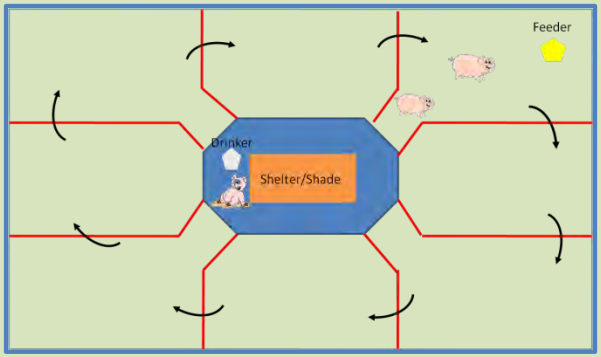
Alternate grazing



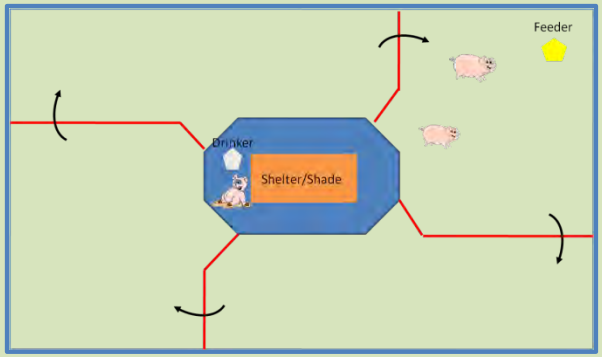
Strip grazing w 1-8



Strip grazing w 9 - 12

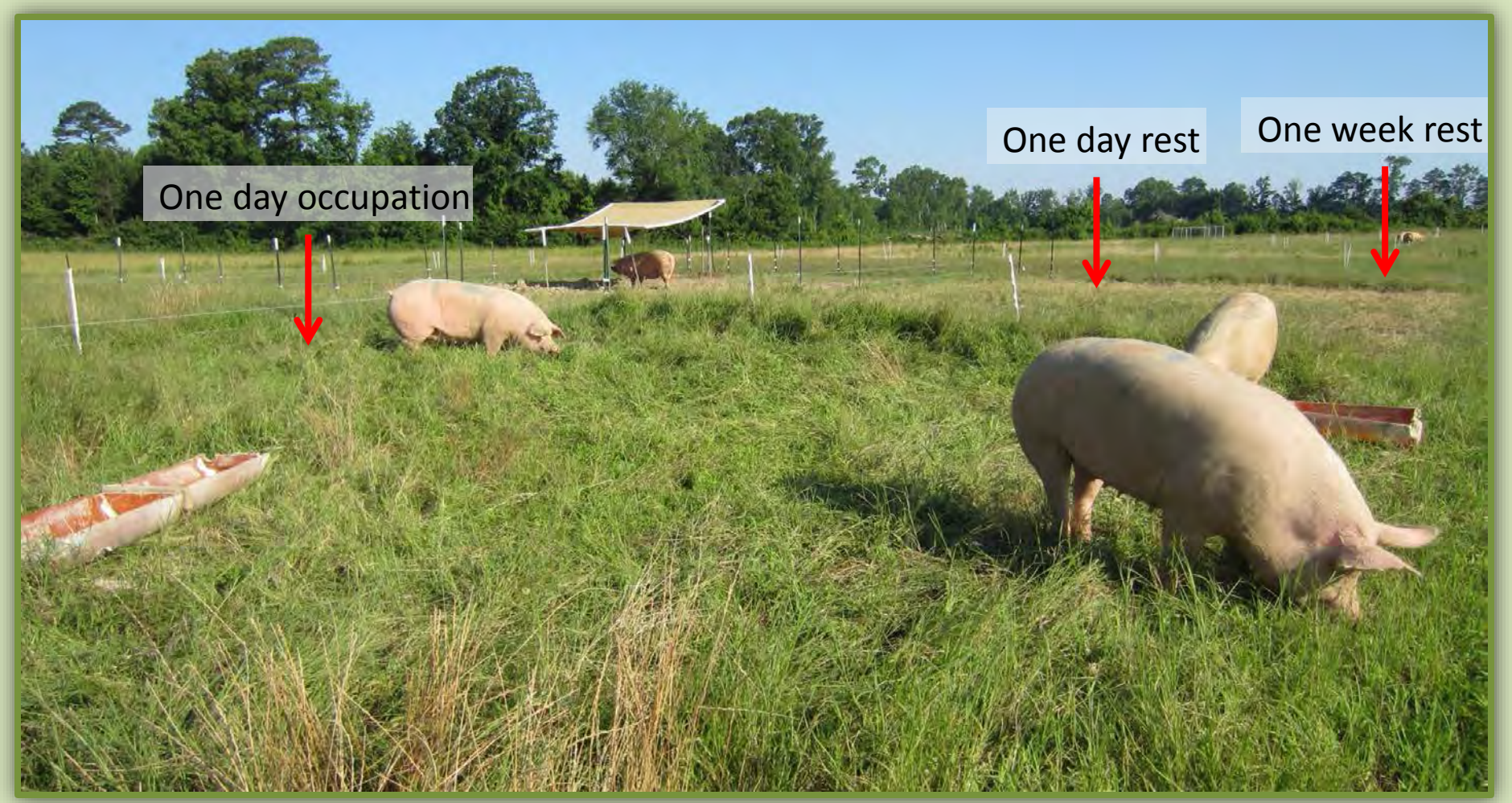


Rotational Grazing w 1- 8



Rotational Grazing w 9 - 12

Implement rotational management



0.37 ac bermudagrass pasture divided in 9 sections: 1 HUA and 8 grazing paddocks
Period of occupation: 1 week
Stocking rate: 4 sows per paddock, equivalent to 11 sows/ac

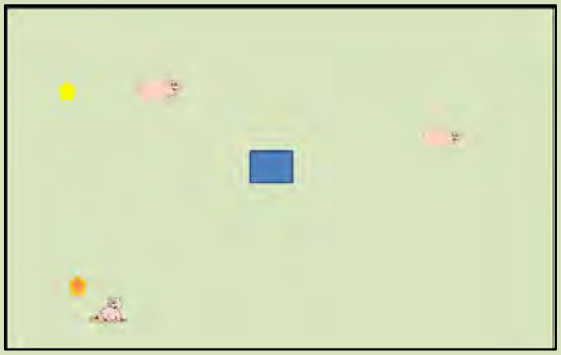
Rotating hogs between paddocks provides rest periods for forages to recover and helps to avoid the build-up of parasites and diseases

Recovery of bermudagrass managed with a stocking rate of 11 sows/ac after 3 weeks of rest. Note the difference in color with the section at left that has not been grazed yet.

Grazing Management Systems

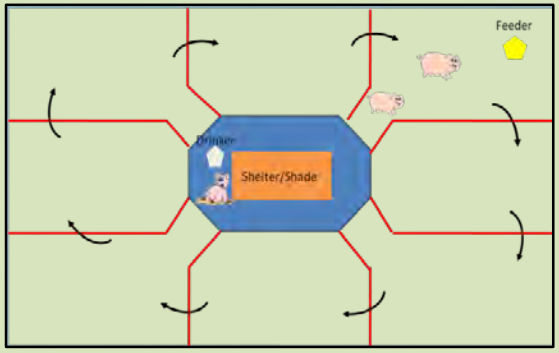
Continuous Grazing

Weeks 1- 12

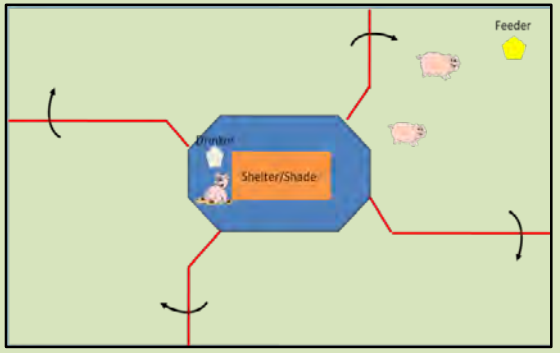


Rotational Grazing

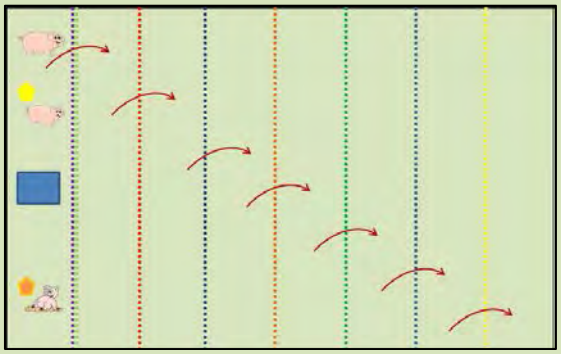
Weeks 1- 8



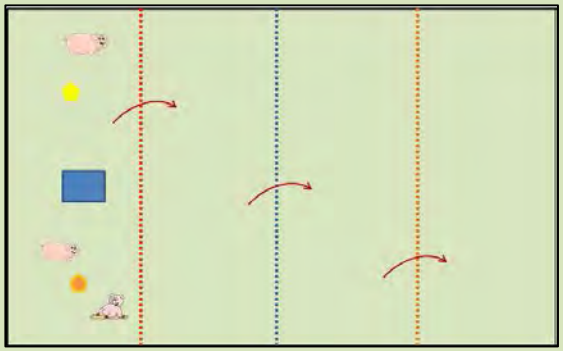
Weeks 9- 12



Strip grazing



Weeks 1- 8

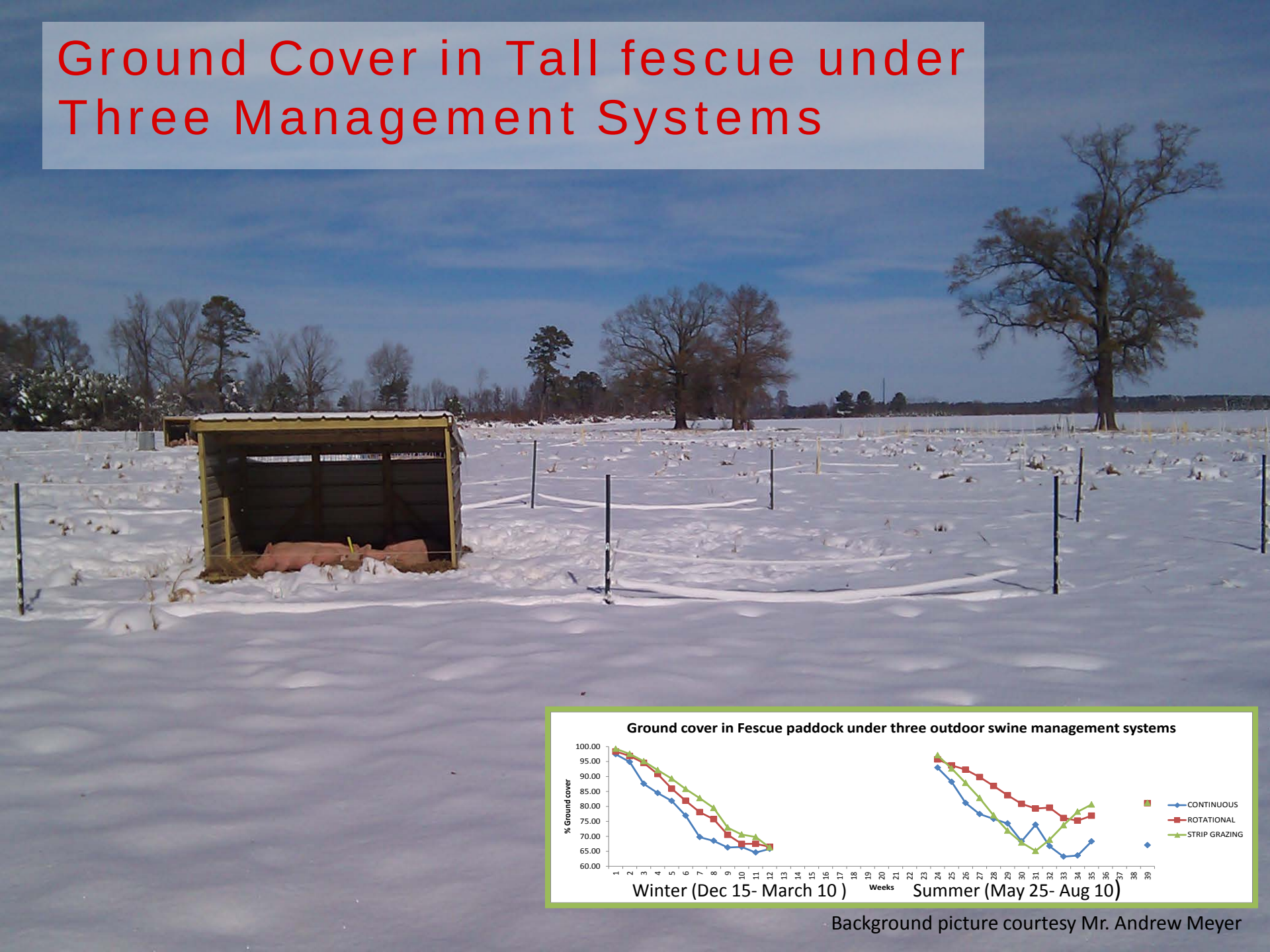


Weeks 9- 12

	Treatments	Area in use	Ft²/pig
Weeks 1-8	Continuous	100 %	2274
	Rotational	22.2 %	505
	Strip grazing	12.5 %	284
Weeks 9-12	Continuous	100 %	2274
	Rotational	33.3 %	758
	Strip grazing	25.0 %	568

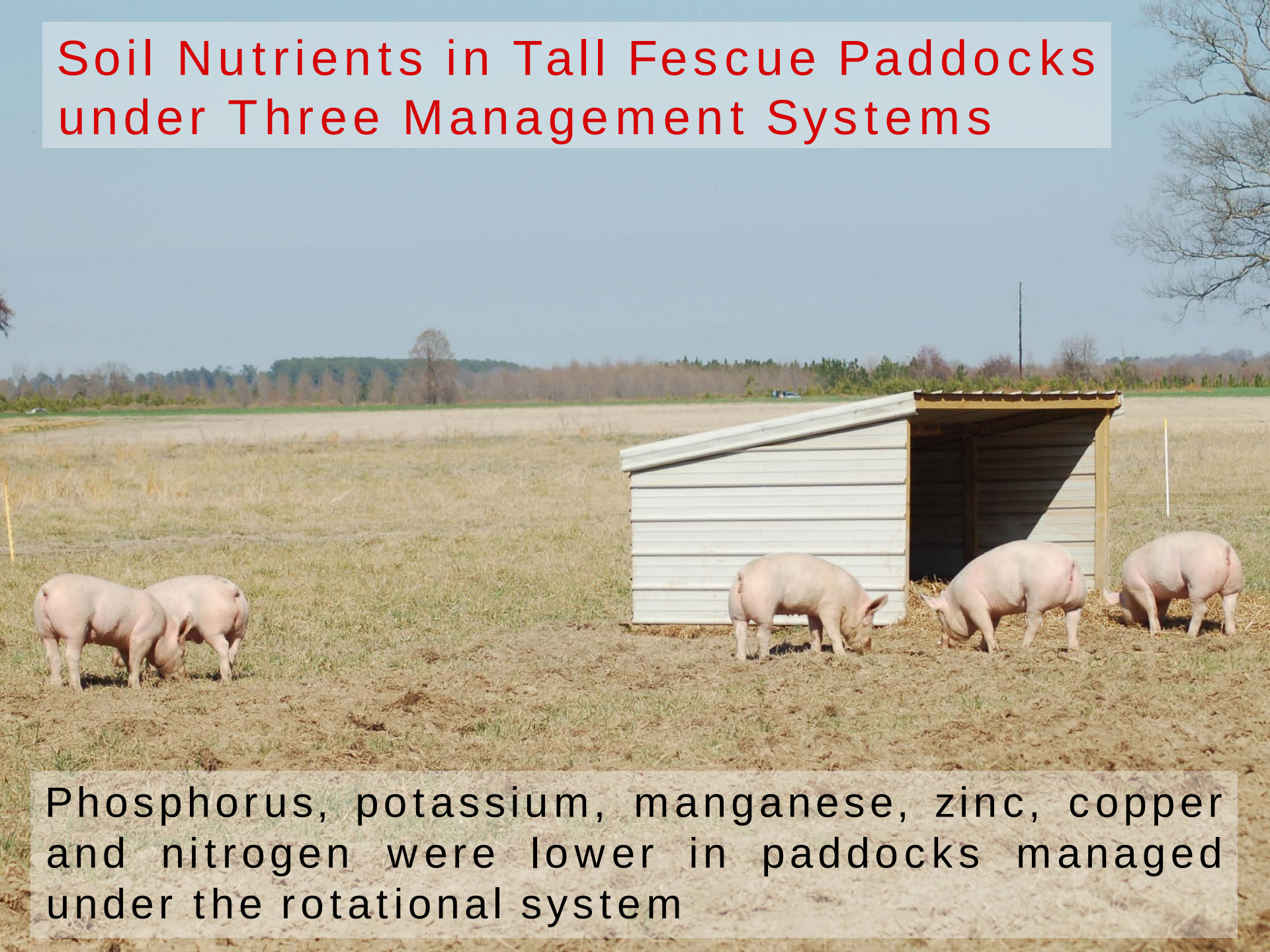
Stocking rate equivalent to 20 hogs/ac (2600 lb/ac)
Paddock size 18192 ft^2

Ground Cover in Tall fescue under Three Management Systems



Background picture courtesy Mr. Andrew Meyer

Soil Nutrients in Tall Fescue Paddocks under Three Management Systems



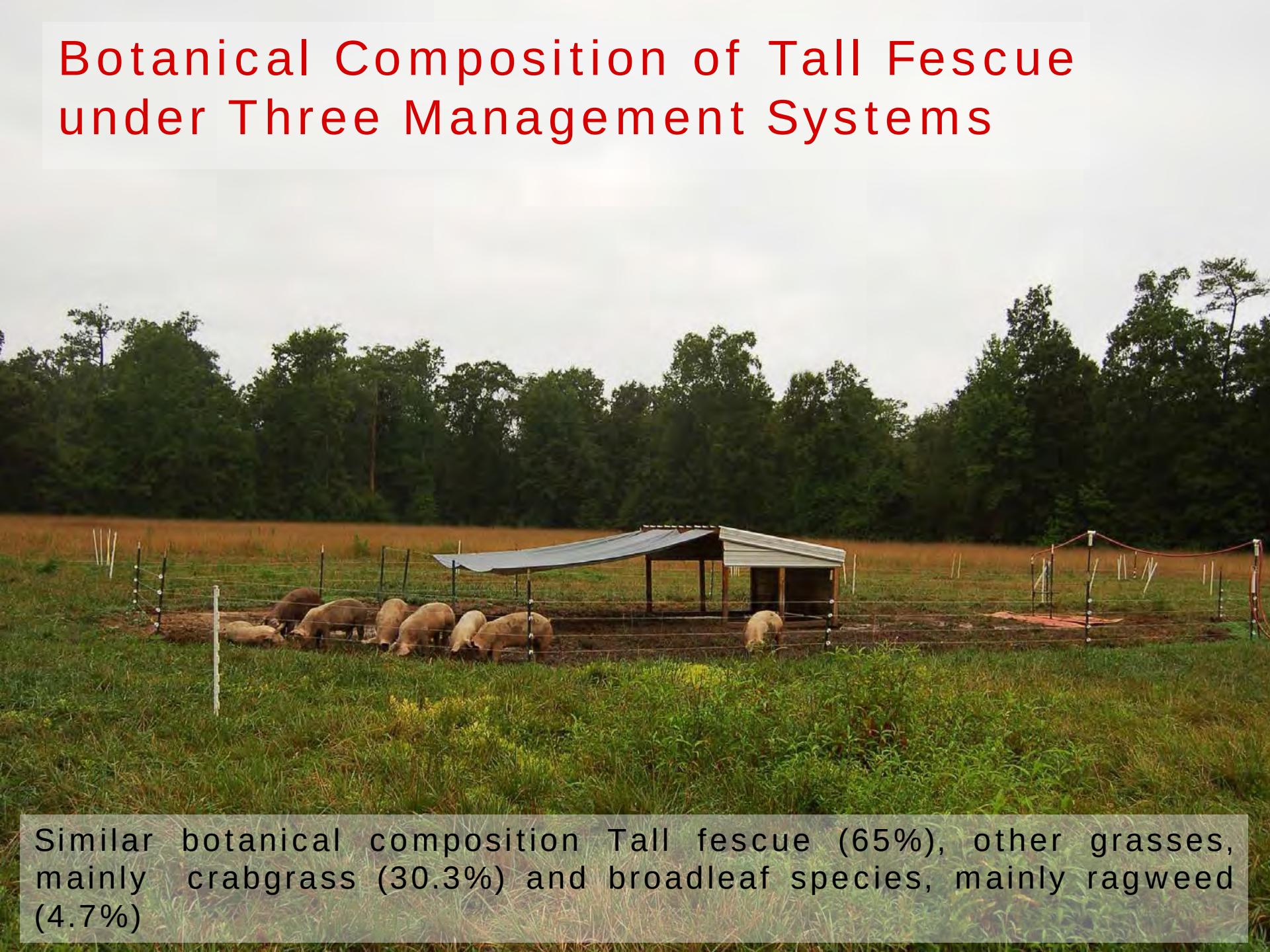
Phosphorus, potassium, manganese, zinc, copper and nitrogen were lower in paddocks managed under the rotational system

Performance of Pigs in Tall Fescue under Three Management Systems

Pigs in Fescue paddocks under the different management system showed the same growth and intake pattern.

Average daily gain	1.61 lb/d
Daily Intake	4.32 lb DM/pig/d
Gain to feed	0.37 lb gain/lb feed

Botanical Composition of Tall Fescue under Three Management Systems



Similar botanical composition Tall fescue (65%), other grasses, mainly crabgrass (30.3%) and broadleaf species, mainly ragweed (4.7%)

Monitor ground cover height

Closely grazed cattle pasture

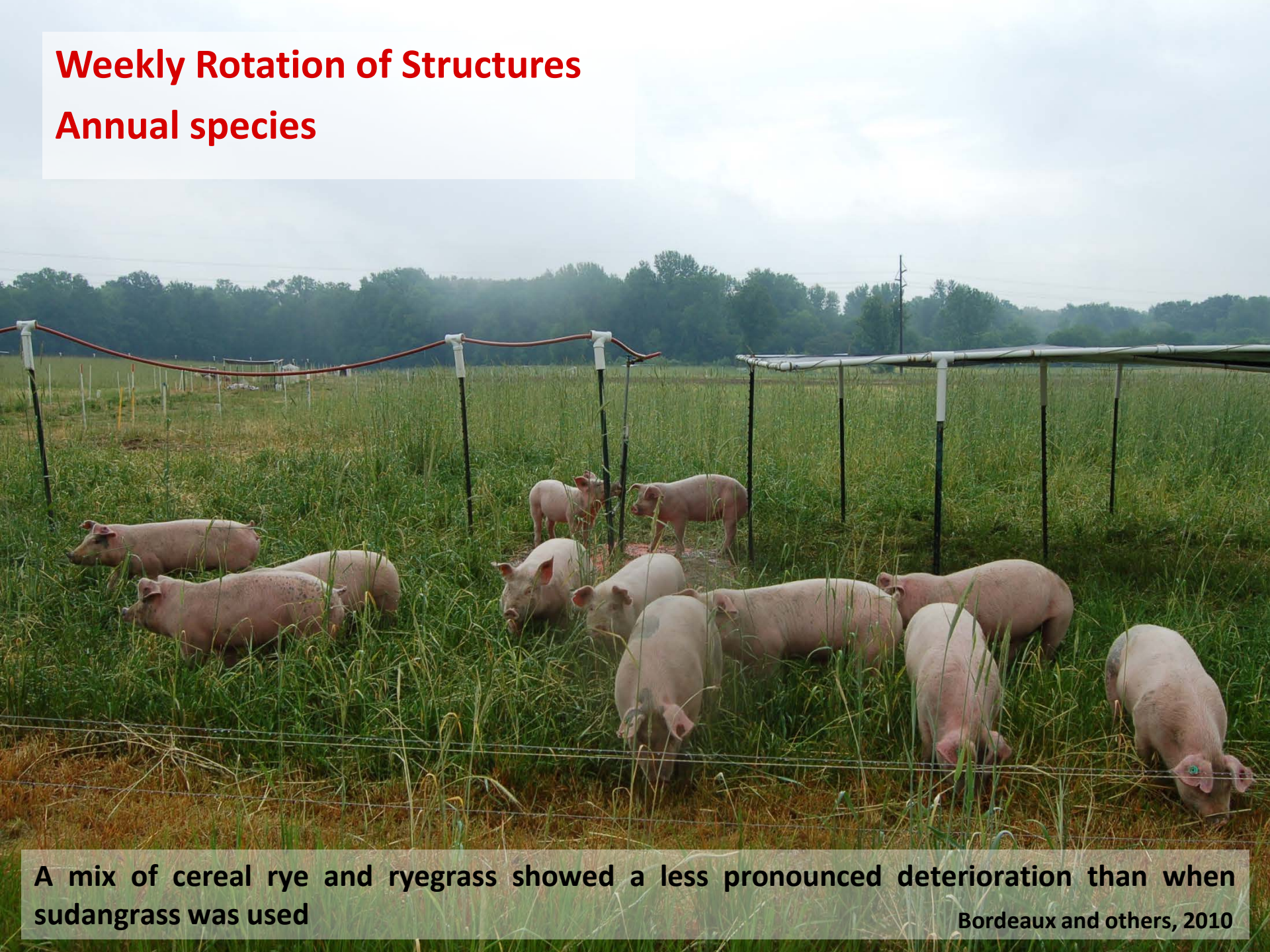
The damage is more severe when the grass is grazed short than if there are several inches of herbage.

Grazing was preferred to rooting when herbage was still available (Andersen and Redbo, 1999)

Ray Cooper farm TN

Weekly Rotation of Structures

Annual species



A mix of cereal rye and ryegrass showed a less pronounced deterioration than when sudangrass was used

Bordeaux and others, 2010

Pig breeds for outdoor production

Balance productivity, suitability to outdoor condition and market preferences

- Adaptation to farm condition, management and goals.
- Hardiness.
- Vitality and disease resistance
- Foraging ability
- Strong legs
- quiet and docile temperament
- Meat quality
- Pigmented skin

Modern genotypes vs Heritage breeds

Pure vs crossbreed

Sows
Prolificacy
Good maternal instincts
Milk production
Good fat reserves
Ease of handling

Boars
Fertility
Good libido
Docile

The Livestock Conservancy
Quick Reference Guide to Heritage Hog Breeds

Photos	Breed	CPL Status	Adult Weight M/F (lbs)	Average Litter Size	Temperament	Adaptations	Use	Optimal Harvest Weight (lbs)	Hanging weight (60% dress out)	Notes
	Hereford	Watch	800/600	10 piglets	docile	Good in any climate and can do well on pasture and confinement	lean meat	250-260	153 lbs	An American breed developed to have same color pattern as Hereford cattle. They make excellent 4-H pigs and will do well in beginners hands. Fast growth rate.
	Gloucestershire Old Spots	Critical	300/275	6-10 piglets	docile	Needs shade so to avoid sunburn of white skin but does well in most climates	lean meat	260-280	162 lbs	Breed created to forage on windfall fruit and dairy by-products such as whey. Known for gentle temperaments and good mothering skills.
	Guinea Hog	Critical	200/150	6-10 piglets	docile	Good in any climate and terrain, can be long-lived	meat and cured products	150-180	100 lbs	Great homestead pig, excels in production of cured meat products. The breed has a close affinity to rural southern culture in America.
	Large Black	Critical	750-650	8-12 piglets	docile	Good in any climate, forages well in wooded areas	meat and cured products	230-250	144 lbs	Produces a very tender meat, has been crossed with Ossabaw to make excellent cured meat products. They are typically very laid back but can become very large.
	Mulefoot	Critical	550-450	5-6 piglets	docile-active	Good in any climate and in wet conditions with its non-cloven hooves	lean meat	250-260	153 lbs	Easy keepers, great choice as homestead pig or for small scale pork production. They are active grazers and perfect for homesteads and or small farm production.
	Ossabaw Island	Critical	300/200 (variable among lines)	6-10 piglets	active	Good in any climate and terrain	meat and cured products	175	105 lbs	Excellent for silvopasturing in woods and for the production of cured meat products. Very active foragers with strong maternal instincts. Best kept in groups as they are very social.
	Red Wattle	Critical	750-550	9-10 piglets	docile	Good in any climate and terrain	lean meat	260-280	162 lbs	Developed in Texas as easy keeper with rapid growth rate, another top choice with chefs. Typically docile but will get very large.
	Tamworth	Threatened	500-600 for both sexes	~10 piglets	docile-active	Good in any climate and terrain, very athletic	lean meat	250-275	160 lbs	Excels on pasture and is an active grazer. This breed is popular with chefs. They are very athletic and will need good fencing to keep them in.

Nutritional requirements

Foraging behavior

Rooting : Seeds, roots, rhizomes, tubers, acorns, nuts, fruit, berries, fungi, insects, earthworms and small animals as snakes and toads.

Grazing: Vegetation.

Protein, energy, minerals, vitamins and water.

Nutritional requirements decrease with age.

Match Feed to Need.

Feed a balanced ration.

Nutritional tables prepared for confinement.

An annual increment of 15% in feed requirement to compensate the higher energy demand of outdoor pigs (exercise and body temperature metabolism) Edwards and Zanella, 1996

Forage to concentrate substitution ratio

Season, forage quality, animal age and physiological status

Spring 4:1
Summer 7:1

9:1 to 10:1 (Danielsen *et al*. 1999)

21.4% saving in sows anual feed, 6.7:1 (Giannone, 2002)

Alternative Feedstuff

Feed is the largest production cost in swine production 60-80

Cost
Large variation in nutritional value
Energy and nutrient digestibility
Antinutritional factors
Palatability
Ease of storage and handling
Risk of toxic residues

http://www.9sites.org/pigcare/health5.htm

Dried Distillers grains with solubles DDGS, field peas, sweet potatoes, sunflower cake, beans meal, wheat shorts, liquid whey, whey permeate, corn steep water, and brewers yeast, beans, cotton seed meal, soybean hulls, alfalfa meal.

Feed can affect growth performance, carcass and pork quality and palatability

Including alternative feedstuffs in diets for pigs

Bred:
The use of bread improved growth and increased fatness.
No negative effect on pork quality.

Whey:
Could be partially substitute for concentrate by mixing the concentrate in a 5:1 ratio with whey, will reduce concentrate use 25 to 30%. Intake 8-15% body weight

Distillers dry grain solubles DDGS:
Use only DDGS with Lysine to protein ratio > 2.8%
May cause belly softness in growing to finishing pigs when use more than 20%, some farmers are sucessfully using up to 35% . Can be include up to 40% in diets for gestating sows.

Pigs feeding programs

Production phase	Diet	Amount of feed/d lb
Gestating sows	Forage F + concentrate C	3.3 – 33 lb of F + 2.2 – 4.4 lb of C
	26.4 lb of grass/legume + 1.1 lb of Concentrate 11 – 13.2 lb of trefoil silage + 2.2 lb of C 8.8 – 11 lb corn silage + 2.86 protein C 3.3 lb of hay +3.3 lb of C 13.2 lb of beet + 2.86 lb of C 11 – 13.2 lb of cooked potatoes (or ensiled)+ 2.2 – 4.4 lb of C	
Lactating sows	Forage + concentrate	< 13.2 lb of F + C
Piglets	Concentrate, Forage and silage	Acidifying effect, prevents diarrhea
Growing pigs	Concentrate, Forage and pasture	< 6.16 lb of C + F + P
Finishing pigs	Forage + concentrate	10-20% of F + C

Simantke and Sundrum 2001

Feeding Strategies

Free Choice: Continuous access to feed. Maximize income per pig place per year. Early marketing. There is also less labor, risk, and carrying cost.

Restricted feeding : encourage pigs to use more forage.

Gestating sows.

Growing to finishing: on limited feeding of concentrates on pasture followed by full feeding for late marketing. Strategy to manipulate carcass and pork quality. Not convenient under 130 lb.

Restricted fed pigs followed for a re alimentation period showed similar gain, but were 5% more efficient than *ad libitum* fed pigs, and required 35 lb less feed to produce the same amount of meat.

Therkildsen *et al*. 2004

Paddock regeneration

Disperse manure
Loose compacted areas
Re seeding
Localized improvements (slot seeding, applying fertilizers and herbicides)

Dry lot management

1. Wide buffers
2. Crop rotation following one or two cycles of hogs

To reduce ground cover damage and soil compaction

Protect HUA with locally available organic materials

The use of perforated slats under feeders and drinkers can help reduce soil compaction

To reduce vegetative ground cover deterioration, soil compaction, nutrients build up and animal health problems

Implement alternatives to wallows


When conditions are far from ideal …
accurate management is required

For a Sustainable Pasture Pork Operation:

Design a flexible production system adapted to the unique circumstances of your farm.

Select an animal breed suitable for outdoor production.

Select a site that minimizes potential runoff to waterways.

Use appropriate vegetation.

Build vegetation buffer filters to limit runoff to waterways or drainage ditches.

Include locally-available feedstuffs in your feeding program.

Implement management practices to reduce environmental impact and adapt them to the season

- Adjust stocking rate and length of animals stay according to climate, soil, drainage and managers' skills.
- Allow your paddock a resting period
- Protect areas sensitive to soil compaction
- Reduce feed wastage
- Plan periodic movements of structures and equipment
- Utilize crops to remove soil nutrients
- Conduct periodic soil tests


Life is more fun
playing in the mud

Estimated growth, feed consumption and feed conversion for pigs*

	Age, days			
	0	50	100	160
Weight, lb	3	50	175	265
Feed intake, lb/d	0.5	3.2	6.0	7.0
Gain, lb/d	0.3	1.8	2.1	1.75
Feed to gain	1.1	2.0	3.0	4.0
Adapted from Life cycle swine nutrition, 1996				

* Estimated from pigs under conventional management

Goals for the feeders (44 to 230 lb) in conventional management

	Good	Better	Best
Age at 230 lb	160	150	140
Days in feeder stage	110	100	90
Average growth rate, lb	3.2	2.85	2.6
Mortality (%)	2.0	0.5	0.1
Carcass index	107	110	112

Comparative performance of SISCAL outdor production system versus indoor housing for pigs

	Outdoor	Indoor	Difference
N piglets born alive	9.94	9.15	0.79
N piglets weaned	9.22	8.47	0.75
Weigh of piglets at birth, lb	3.45	3.34	0.11
Weight of piglets at weaning, lb	23.32	19.32	4
Mortality birth-weaning, %	6.52	9.27	2.75
Total feed intake lactation Sow, lb	528	444	84
Interval weaning-heat, d	7.67	5.40	2.27
Piglet production cost/kg US $	1.103	1.645	0.542

Dalla Costa *et al.* 1994

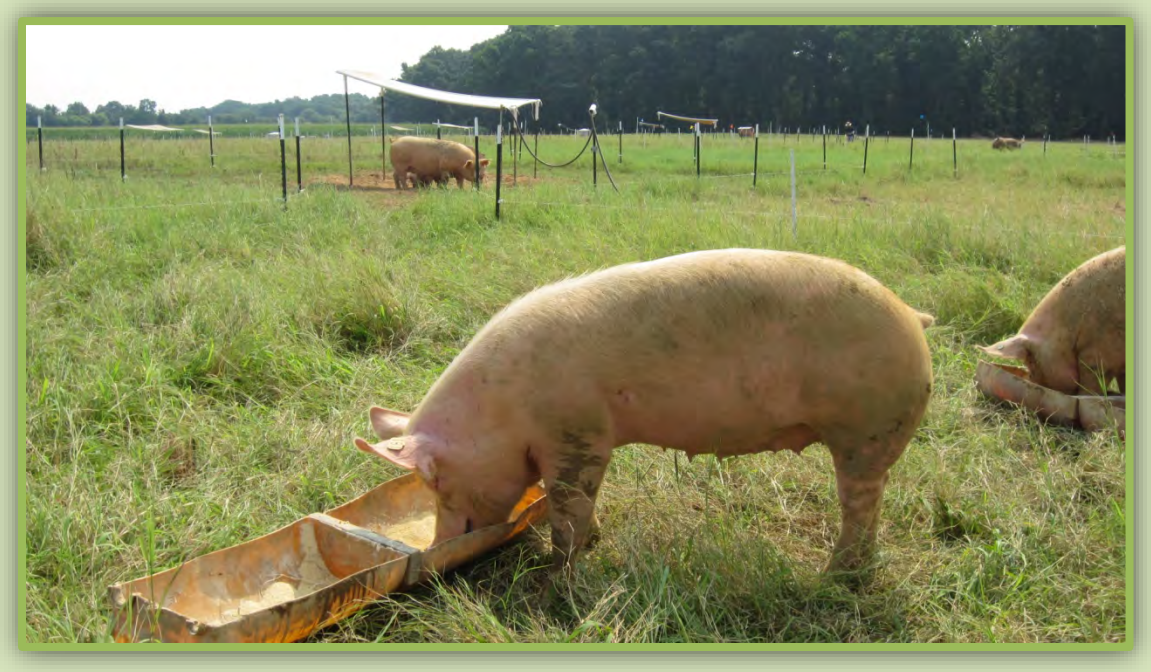
A guide to feeding hogs

Sex/Age class	Type of feed	Protein	Amount fed (per day)
Birth to weaning	Hog starter	18-21%	Free choice.
Weaning to market	Hog grower	15-16%	Full feed. Feed may be limited to 70-90% of full feed after hogs reach 57 kg (125 lb.)
Flushing gilts	Sow feed	15-16%	2.7-4 kg (6-9 lb.) for 3 weeks before breeding.
Gestating gilts	Sow feed	15-16%	1.8-2.7 kg (4-6 lb.) or 1.5-2% body weight; if gilts are too thin, increase by 0.5-1 kg (1-2 lb.) in the last 3-5 weeks.
Gestating sows	Sow feed	15-16%	1.3-2.7 (3-6 lb.) or 1-1.5% body weight; if sows are too thin, increase by 0.5-1 kg (1-2 lb.) in the last 3-5 weeks.
Lactating sows	Sow feed	15-16%	Full feed, approx. 4.5-6.4 kg (10-14 lb.)
Boars	Sow feed	15-16%	1.3-1.8 kg (3-4 lb.) when not breeding, 2.7-3.2 kg (6-7 lb.) when being used.

Modified from *Life Cycle Swine Nutrition*. Iowa State Univ. Ames, Iowa, 1988.

Feeders

Feeders	N of pigs/hole	
	Weaned (33-66 lb)	4
	Growers (66-110 lb)	3
	Fatteners (110 lb-Market)	2
	Gestating sow	1



Water requirements

Gallons/head/day	
Nursery Pigs (up to 60 lbs)	0.7
Grower Pigs (60 to 100 lbs)	2-3
Finishing Pigs (100 to 250 lbs)	3-5
Non pregnant gilts	3
Pregnant sows	3-6
Lactating sows	2.5-7
Boars	5

Aim for a cool water supply 18-20°C

Supply lines buried or insulated

Nipple drinkers
Match water pressure to age group
– 0.5litres/min for piglets and weaners,
1.0litres/min for growing pigs and dry sows
2.0litres/min for lactating sows.

Waterers should be placed over slats

Space allowance for huts, ark, shelter and shade

	Minimum space allowance (sq feet/head)		
		AWA*	Others
Breeding pigs	Boars	16	16
	Gilts and dry sows	16	16
	Gestating gilts and sows		46
	Farrowing and Lactating sows	42	46
Fattening pigs	Up to 66 lb	3	6.5
	Up to 110 lb	4.5	9.7
	Up to 187 lb	7	14
	Up to 242 lbs	8.5	14

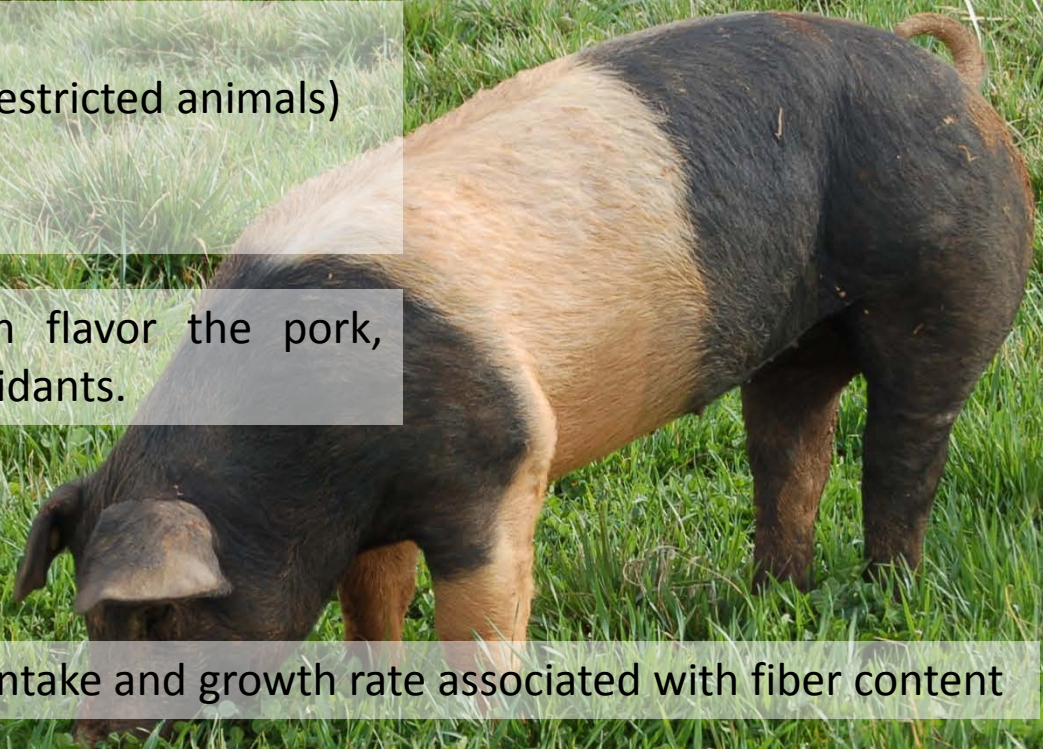
*Animal welfare approved standard

Protection against cold, rain, high winds, extreme temperatures and sunburn

Effect of forages

Beneficial for welfare,
satiety (bulky diet, feed restricted animals)
Desirable gut microorganism
Reduction of gastric lesions

Compounds that potentially can flavor the pork, unsaturated fatty acids and antioxidants.



Negative effects on total nutrient intake and growth rate associated with fiber content

Including grass in the diet improve carcass quality by avoiding excessive fat deposition
(Simantke and Sundrum 2001)

Pigs on pasture have higher levels of PUFA, n-3 fatty acids and vitamin E than indoor pigs
(Nilzen et al 2001, Hogberg *et al*. 2002)

Animals fed concentrate ad libitum show low forage intake < 5% of daily DM Intake
(Edwards 2003)

Pastures for hogs

Forages are good source of crude protein, minerals and vitamins for pigs.

(Edwards, 2003)

- High in fiber, limited value for young pigs and lactating sows.
- Better utilization after two months of adaptation
- Pigs tend to concentrate their activities to certain areas, will overgraze some sites and under graze others.

Potential pasture crops to provide soil cover for the finishing phase of outdoor hog production

Finishing hogs on pasture continuously for 4 months follwowed by 8 months of rest on each pasture. No nutrients being taken off.

Pen #	Months		1st year	2nd year	Renovation crops following a finishing cycle
	Hogs	No Hogs	Base Crops in each pasture (choose grasses with rhizomes, stolons)	Possible renovation needs following 4 months of finishers	Annual crops that would cover the soil quickly following 4 months of hogs
1	Jan-Apr	May - Dec	Mostly Fescue mixed with some Bermuda	Renovate with Bermuda in May-Jun or Fescue in Aug.	bermuda; crabgrass, sorghum, sudan, millet, teff, lovegrass
2	Feb-May	Jun-Jan			
3	Mar-Jun	July - Feb.		Renovate with Bermuda in Jly or Fescue in Aug	
4	Apr-Jly	Aug-Mar	Mostly Bermuda with some Fescue		fescue, ryegrass, rape
5	May-Aug	Sep-Apr		Renovate with Fescue in Sept-Nov & Bermuda in March	
6	Jun-Sep	Oct-May	Mostly Bermuda; Perhaps fall overseeded with Smallgrain		
7	Jly-Oct	Nov.- Jun			fescue, rye, rape
8	Aug-Nov	Dec-Jly		Renovate with Cereal Rye & Fescue in Dec-Feb & Bermuda in March	fescue, rye
9	Sep-Dec	Jan-Aug			rye
10	Oct-Jan	Feb-Sep	Mostly Bermuda with some Fescue		fescue, rye
11	Nov-Feb	Mar-Oct	Mostly Fescue mixed with some Bermuda	Renovate with Fescue and Bermuda in March - April	bermuda, rape, crabgrass
12	Dec-Mar	Apr-Nov			bermuda, crabgrass, sorghum, sudan, millet, teff, lovegrass

Paddock size: 1.33 ac

28 pigs/paddock (21 heads/ac)

Green 2015

Potential crops to provide temporary soil cover during the "rest period" between groups of finishing animals on drylot-crop rotation farms.

Two groups of finishing hogs on drylot during one year. The area would be rotated into crops for 2 subsequent years.

Dry Lot Pen #	1st Use Period	1st Rest Period	Potential crops planted at high seeding rates to provide temporary cover during the dry lot rest period.	2nd Use Period	2nd Rest Period	Potential crops planted at high seeding rates to provide temporary cover during the dry lot rest period.
1	Jan-Apr	May-Jun	Crabgrass, Millet, Sudan, Teff, Lovegrass, Buckwheat	Jly-Oct	Nov-Dec	Cereal Rye &/or Brassicas
2	Feb-May	Jun-Jly	Crabgrass, Millet, Sudan, Teff, Lovegrass, Buckwheat	Aug-Nov	Dec-Jan	Cereal Rye &/or Brassicas
3	Mar-Jun	Jly-Aug	Crabgrass, Millet, Sudan, Teff, Lovegrass, Buckwheat	Sep-Dec	Jan-Feb	Cereal Rye &/or Brassicas
4	Apr-Jly	Aug-Sep	Crabgrass, Millet, Sudan, Teff, Lovegrass, Buckwheat	Oct-Jan	Feb-Mar	Cereal Rye &/or Brassicas or Ryegrass
5	May-Aug	Sep-Oct	Cereal Rye, Oats, Brassicas	Nov-Feb	Mar-Apr	Cereal Rye, Oats&/or Brassicas or Ryegrass
6	Jun-Sep	Oct-Nov	Cereal Rye, Oats, Brassicas	Dec-Mar	Apr-May	Crabgrass,Sudan, Buckwheat

Green 2015

Nutrient loading for farrow to finish operation

Years of continuous use	Plant Available Nutrients excreted onto the site lbs/acre			Change in Soil Test P-Index with no crop removal fom site.
YR	N	$P_2 0_5$	$K_2 0$	P-I
1	72	72	94	15
2	143	144	188	29
3	215	217	282	44
4	287	289	377	59
5	358	361	471	74

Stocking rate: 1 sow + 14 pigs/ac/yr

Nutrient loading from Feeder to Finish operation

Feeder-Finishers, Hd/acre (based on 220 Mkt wt.)	Years on same site	Plant Available Nutrients excreted onto the site, lbs/acre			Change in Soil Test P-Index with no crop removal from site
		N PAN	$P_2 0_5$ PAP	$K_2 0$ PAK	P-I
14	1	56	49	67	10
28	1	112	98	133	20
56	1	224	196	266	40
14	5	280	245	333	50
28	5	560	490	665	100
56	5	1120	981	1330	200

Stocking rates 14 to 56 head/ac/yr

Poisonous Plant to Pigs

Scientific Name	Common Name(s)	Parts Poisonous
Amaranthus spp.	Pigweed	leaves
Amsinckia intermedia	Fiddleneck	seeds
Brassica spp,	Rape, Cabbage, Turnips, Broccoli, Mustard	roots, seeds
Chenopodium album	Lambs Quarters	all
Conium maculatum	Hemlock	all
Crotalaria spectabilis	showy crotalaria	all
Datura stramonium	Jimsonweed	all, seeds
Iris spp.	Irises	rhizomes and rootstocks
Kalmia latifolia K. angustifolia	mountain laurel sheep laurel	leaves
Laburnum anagyroides	Golden Chain, Laburnum	pods, seeds, all
Nicotiana spp.	Tobacco, Tree Tobacco	leaves
Phytolacca americana	Pokeweed	all, root
Podophyllum peltatum	Mayapple, Mandrake	all
Prunus spp.	Wild Cherries, Black Cherry, Bitter Cherry, Choke Cherry, Pin Cherry	seeds, wilted leaves, bark, twigs
Pteridium aquilinium	Bracken Fern	all
Ranunculus abortivus	Buttercup	all
Rheum rhaponticum	Rhubarb	leaves
Rhododendron maxima R catawbiense	Great laurel Rosebay Rhododendron	leaves
Ricinus communis	Castor bean	all, seeds
Sorghum halepense	Johnsongrass	all
Xanthium strumarium	Cocklebur	seedlings, seeds

Adapted from **Plants Poisonous to Livestock,** Cornell University and **Poisonous plants in pastures**. University of New Hamsphire

On farm feedstuffs that can be included in swine diets

Weight lb	Amount lb/d	Field peas %	Corn %	Wheat %	Barley %
66 - 110	3.3	35	30	20	15
110 – 154	4.4	30	35	20	15
154 – 198	5.5	25	40	20	15
198 – 242	6.6	20	45	20	15
> 242	7.7	15	50	20	15

Carcass quality from pigs under different production systems in Uruguay

	Production systems			
Genotype	Duroc x Pampa	Duroc xPampa	Duroc x Pampa	Pampa
Housing	Indoor	Outdoor	Outdoor	Outdoor
Feeding Restriction	Light (85%)	Light (85%)	Moderate (70%)	Moderate (70%)
Carcass yield, %	82.7	83.7	82.4	83
Carcass length, in	38.2	37.8	38.3	38.6
Backfat thickness, in	$1.41^{a,b}$	$1.49^{a,b}$	1.32^{b}	1.50^{a}
$pH_{45\ min}$ Ham	6.28	6.31	6.36	6.54
$pH_{24\ hr}$ Ham	5.74	5.64	5.65	5.77
$pH_{24\ hr}$ Loin	5.52	5.51	5.50	5.69
Loin eye area, in	4.34^{b}	$4.54^{a,b}$	4.99^{a}	3.94^{b}

Final weight 235 lb

Mixed pastures: Chicory (*Cichorium intybus*), red clover (*Trifolium pratense*) and raygrass (*Lolium multiflorum*)

Effect of substituting the corn with bread in diets for Cinta Senese pigs

	Concentrate	Including bread
Initial weight, lb	305	292
Final weight, lb	332	356
ADG, lb	0.526[b]	0.869[a]
Dressing percentage, %	82.4	83.9
pH45 min	6.41	6.47
Backfat thickness LT, in	1.7[b]	2.2[a]
Backfat thickness GM, in	2.0[b]	2.6[a]

Corn, barley, faba bean, wheat bran, bread and minerals
70 d
Outdoor (7 pigs/ac)
The use of bread improved growth and increased fatness.
No negative effect on pork quality.
Energy value of bread is underestimated in nutritional tables.

Sirtori *et a*l 2007

Liquid whey

Sweet whey: Higher protein and lactose content and more palatable, no more than 48 hr of storage. Could be partially substitute for concentrate by mixing the concentrate in a 5:1 ratio with whey, will reduce concentrate use 25 to 30%.

Acid whey: Higher minerals (Ca and P) content, can be stored up to 1 week.

26- 31 lb of whey can substitute 2.2 lb of concentrate

Storage tanks, troughs and distribution equipment should be made of plastic, porcelain or stainless steel.

Whey daily intake	
Hog's Live Weight LW, lb	No more than % of LW
44 to 176	15 %
198 to 264	10 %
264 to 396	8 %
Can be fed to gestating sows, but is not convenient for lactating sows	

Low fat milk	
Hog's Live Weight LW, lb	US Gallons/d
44 to 88	0.53-0.79
88 to 132	0.79-1.06
132 to 242	1.32
Sows and boars	2 to 3

Dried whey up to 20- 30% of the starter diet, and should be limited to 10% for older pigs

Distillers dry grains with solubles DDGS

Ethanol production Barley, wheat, sorghum and corn.

DDGS are co-product.

Use only DDGS with Lysine to protein ratio > 2.8%

Inclusion limited by fiber content and for finishing pigs, also by the content of unsaturated fatty acids.

The use require carefully formulation
May improve intestinal health
May increase litter size
Diets are bulkier
May be initial reduction of feed intake
May cause belly softness when use more than 20%, some farmers are sucessfully using up to 35%

In diets for lactating sows, weaned pigs (from 2 weeks after weaning) and to growing-finishing pigs up to 20%. At least 40 % in diets for gestating sows.

Growing animals (50-60 Kg)	
Fed Concentrate	**Organic matter intake from forage %**
Ad libitum	2-15
Restricted 30%	32 %*
*11% Reduction of average daily gain	

Mowat *et al*. 2001, Danielsen *et al*. 1999

Including grass in the diet improve carcass quality by avoiding excessive fat deposition

(Simantke and Sundrum 2001)

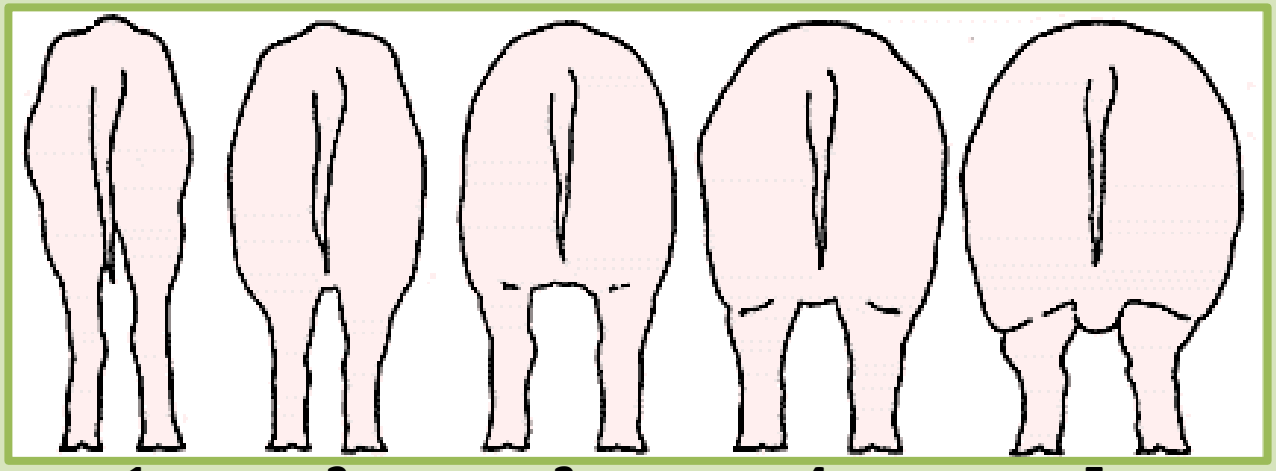
Weaning age

The longer the piglets are with the sow, and the stronger they are at weaning, the more rapid is their liveweight increase, from weaning to market weight.

The ideal age is eight weeks.

The sow is mated again at the first heat period after weaning (4-5 d after piglets removal). The next litter will be bigger than if you wait for a later heat period.

Body Condition Score



10th rib backfat depth

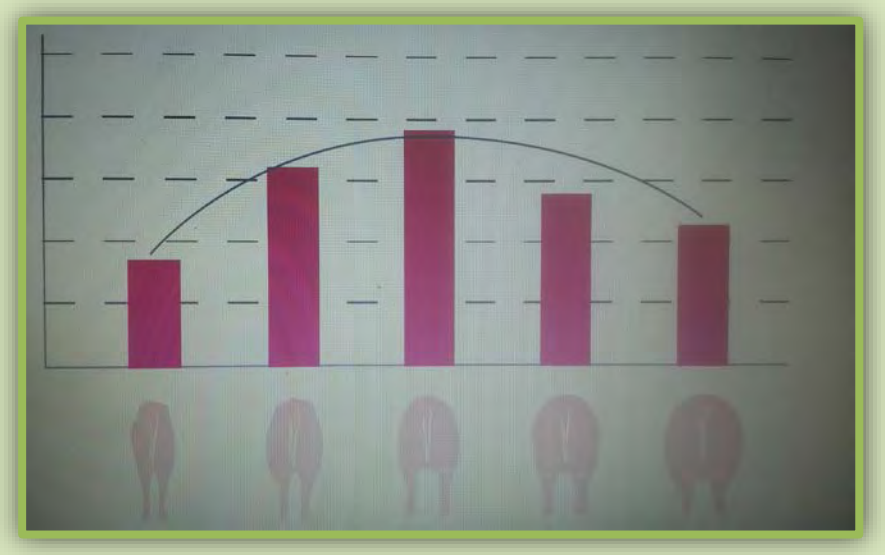
<0.6”	0.6-0.7”	0.7-0.8”	0.8- 0.9”	> 0.9”
Emaciated	**Thin**	**Ideal**	**Fat**	**Obese**

Condition Score	Definition
1	Bones clearly visible
2	Bones can felt without pressure when the palm of the hand is laid flat on the skin
3	Bones can felt only with firm pressure when the palm of the hand is laid flat on the skin
4	Bones can only be felt when fingertips are pressed into the skin
5	No Bones can be felt

Feel the bones: Backbone, ribs, pin bones

Sows Body Condition Score and litter size

Sows Body Condition Score and litter size



All sows should be between BCS 3 and 3.5 at farrowing, and not less than BCS 2 at weaning

"Only sows in good shape and with good milk production will care best for the piglets. Further on, a low weight loss in lactation will lead to a higher litter size in following cycle".

Dr Gunner Sorensen,
Danish Agriculture and Food Council's Pig Research Centre

Heavy Pigs (Growing-finishing phase) , Body Weight, Weight gain and Feed Intake

WEEK	DAYS	BODY WEIGHT lb		Daily Gain lb/d	INTAKE		
		INITIAL	FINAL		lb/d	lb/week	TOTAL lb
1	1 - 7	66.14	75.86	1.39	3.17	22.22	22.22
2	8 - 14	75.86	85.78	1.42	3.45	24.17	46.39
3	15 - 21	85.78	95.94	1.45	3.73	26.11	72.50
4	22 - 28	95.94	106.35	1.49	4.04	28.27	100.77
5	29 - 35	106.35	117.09	1.53	4.33	30.34	131.11
6	36 - 42	117.09	128.09	1.57	4.62	32.35	163.46
7	43 - 49	128.09	139.42	1.62	4.87	34.11	197.56
8	50 - 56	139.42	151.04	1.66	5.09	35.63	233.20
9	57 - 63	151.04	162.72	1.67	5.31	37.19	270.39
10	64 - 70	162.72	174.47	1.68	5.53	38.72	309.11
11	71 - 77	174.47	186.29	1.69	5.74	40.19	349.29
12	78 - 84	186.29	198.08	1.68	5.94	41.61	390.90
13	85 - 91	198.08	209.88	1.68	6.11	42.79	433.69
14	92 - 98	209.88	221.65	1.68	6.26	43.80	477.49
15	99 - 105	221.65	233.29	1.66	6.40	44.83	522.32
16	106 -112	233.29	244.84	1.65	6.55	45.88	568.20
17	113 - 119	244.84	256.26	1.63	6.70	46.91	615.11
18	120 - 126	256.26	267.55	1.61	6.85	47.95	663.06
19	127 - 133	267.55	278.64	1.58	6.99	48.95	712.01
20	134 -140	278.64	289.55	1.56	7.13	49.94	761.95
21	141 - 147	289.55	300.27	1.53	7.25	50.77	812.72
22	148 -154	300.27	310.80	1.51	7.33	51.30	864.02
23	155 - 161	310.80	321.12	1.47	7.37	51.59	915.61
24	162 - 168	321.12	331.24	1.45	7.40	51.78	967.38
25	169 - 175	331.24	341.05	1.40	7.42	51.91	1019.30
26	176 - 182	341.05	350.75	1.39	7.43	52.04	1071.33
27	183 - 189	350.75	360.45	1.39	7.46	52.19	1123.53
28	190 - 196	360.45	369.49	1.29	7.48	52.38	1175.90
AVERAGE				1.55	6.00		