Enhancing Artificial Insemination Results
改善人工授精结果

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海南

恩睿康 Enable

Successful Mating Program
成功的配种程序

Goals are met 达到目标

Farrowing crates are full (Scheduling) 产房：高效有序

Farrowing index – (Live) Pigs per 100 sows serviced
分娩指数 ---100 头母猪情期配种产活仔数

Optimum use of available resources 可用资源合理配置

Elements of Successful Mating Program
成功配种计划包括

Females 母猪

Boar Power 公猪力

Man Power 人工

Facilities 设施

Organization 组织

Females 母猪

Gilts – Old Enough, Big Enough 7-8 months, 130 + kg

后备 -- 日龄够大，体格够大， 7-8 月龄， 130 公斤以上

Sows – Junk culled out regularly

经产母猪 -- 定期淘汰不合格母猪

Replacement Rate 35-45%

更新率 35-45%

Mortality 3 to 6% annually

年死亡率 3-6%

Health & Soundness

健康度和结实度

Offspring suitable for the Market 后代适合市场需要

Health 健康

Structural soundness 结构紧实

Free from Chronic Disease 无慢性疾病
PRRS，蓝耳
PRV，伪狂犬病
PCV2，圆环 2
CSF，经典猪瘟
Chronic ASF，慢性非洲猪瘟
Streptococcosis 链球菌

Major Health Problems Commonly Transmitted by Semen or Contamination of Semen
经常通过精液或者精液的污染而传播的主要健康问题

PRRS 蓝耳病
Pseudorabies 伪狂犬病
Porcine Epidemic Diarrhea 流行性腹泻病
PED/TGE-like related coronaviruses 类 PED/TGE 的相关冠状病毒病
Classical Swine Fever 经典猪瘟
Swine Dysentery??? (perhaps not... but...?)
猪痢疾 ??? （也许不是 ..... ，但是 ..... ？ ）
Brucella suis and Leptospirosis (Historically)
（历史来看）猪布鲁氏菌病和钩端螺旋体病

Even front toes with slight spread, good slope and cushion to the pastern allows the foot to set squarely on the floor surface.

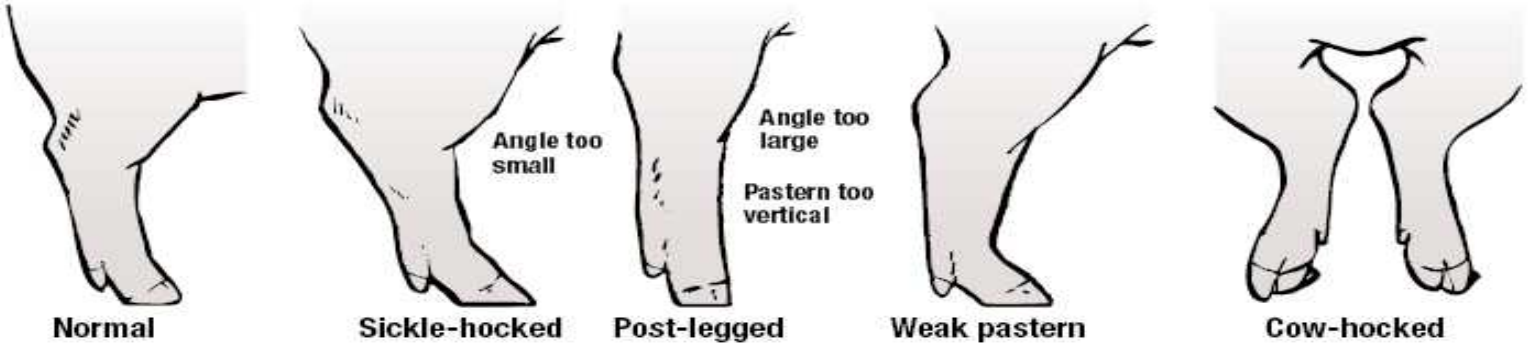
Even rear toes with slight spread, good shape and cushion to the pastern allows the foot to set squarely on the floor surface.

Figure 5. A pig with a common defect—small inside toes.

Figure 7. Cracks and ulcers on the bearing surface of the foot.

- Structural defects are highly heritable and are transmitted
- to the offspring, resulting in sows with unsoundness.
- 结构缺陷高度可遗传，可传给后代，而导致母猪结实度欠佳

Side view of rear leg



- ok
- X
- X
- ok
- X

Weak rear pasterns are considered undesirable. In severe cases, damage to hocks and dew claws can result.

When the angle of the hip, stifle and hock is too large, the animal is described as "post-legged."

Side view of front leg

Normal
- ok

Weak pastern
- ok

Buck-kneed
- X

Splay-footed (toes pointed out)
- X

Pigeon-toed (toes pointed in)
- X

This side view shows normal (good) front leg structure. Note how the front legs slope from the shoulder.

This is an example of soft (weak) front pasterns. Note the full dew claw touching the floor.

Straight front legs often cause knee joints to buckle, often called "buck-kneed."

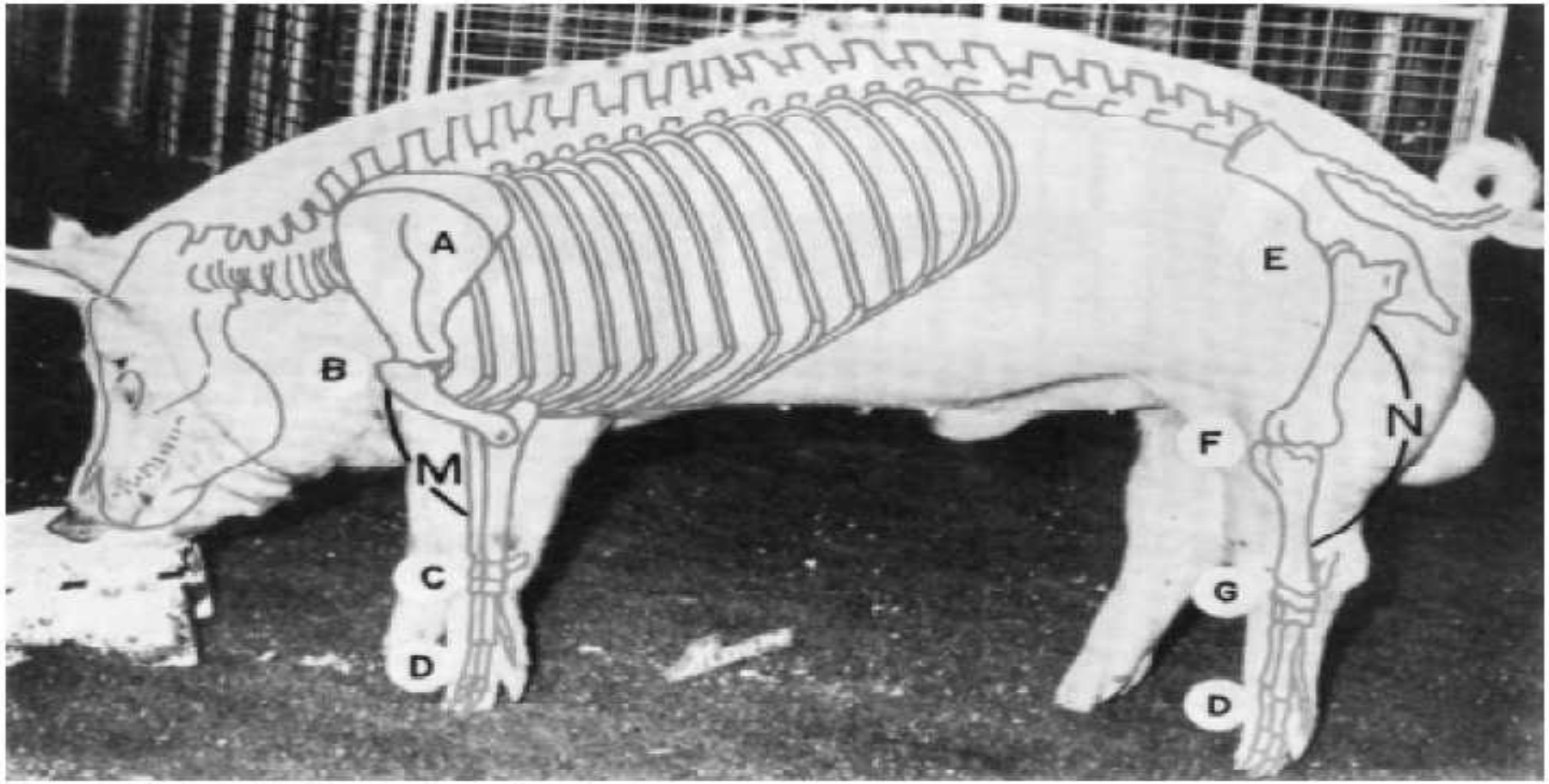


Figure 1. Undesirable front and rear leg structure.

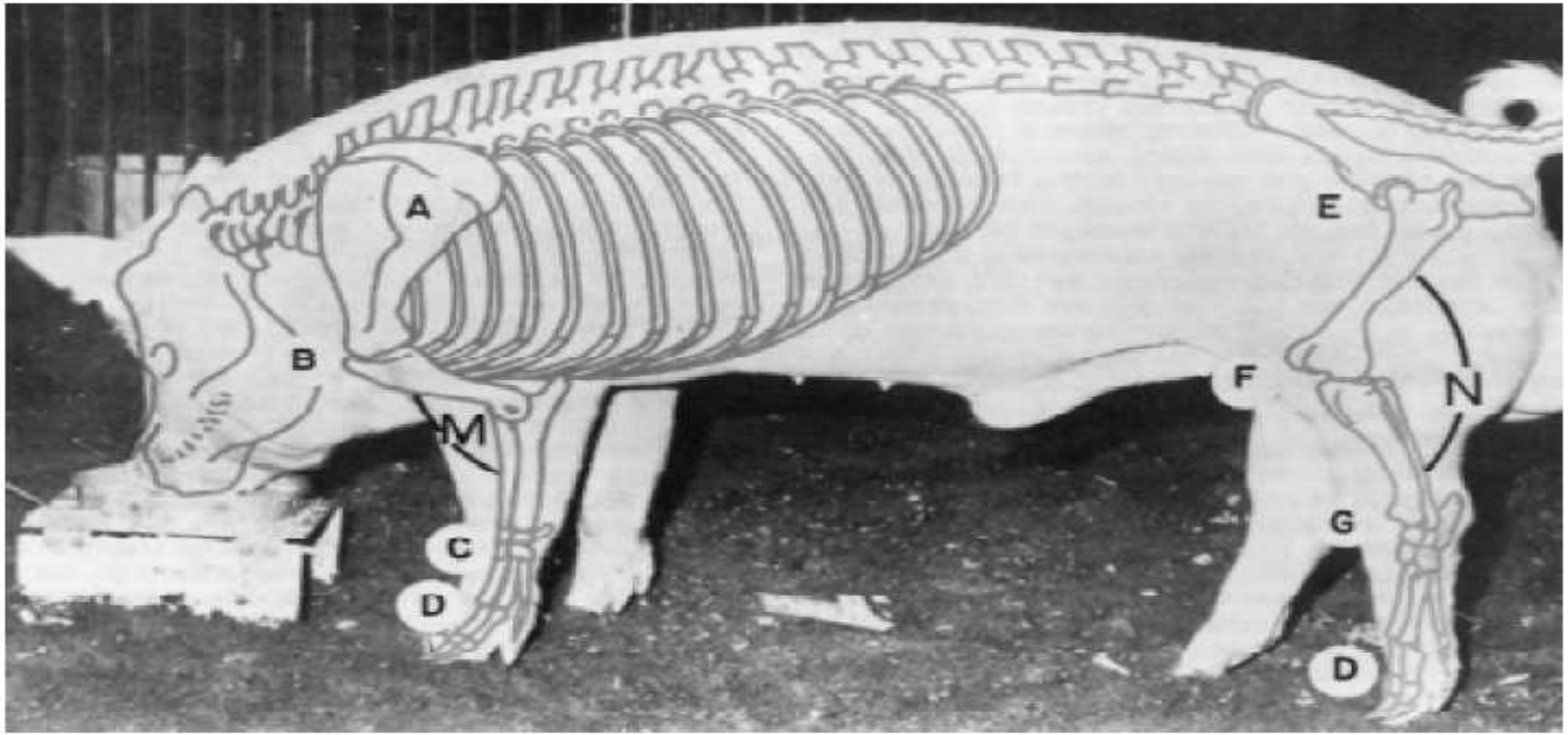
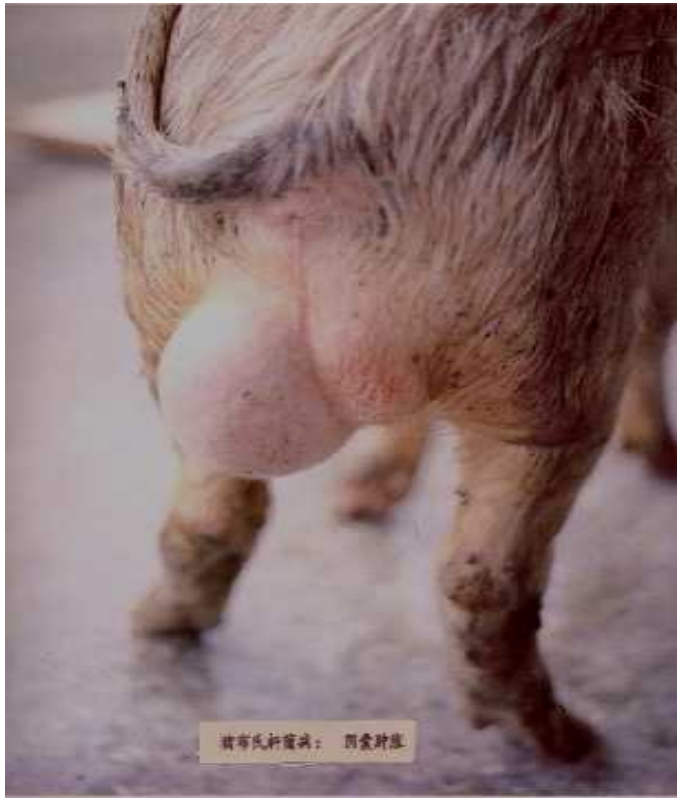


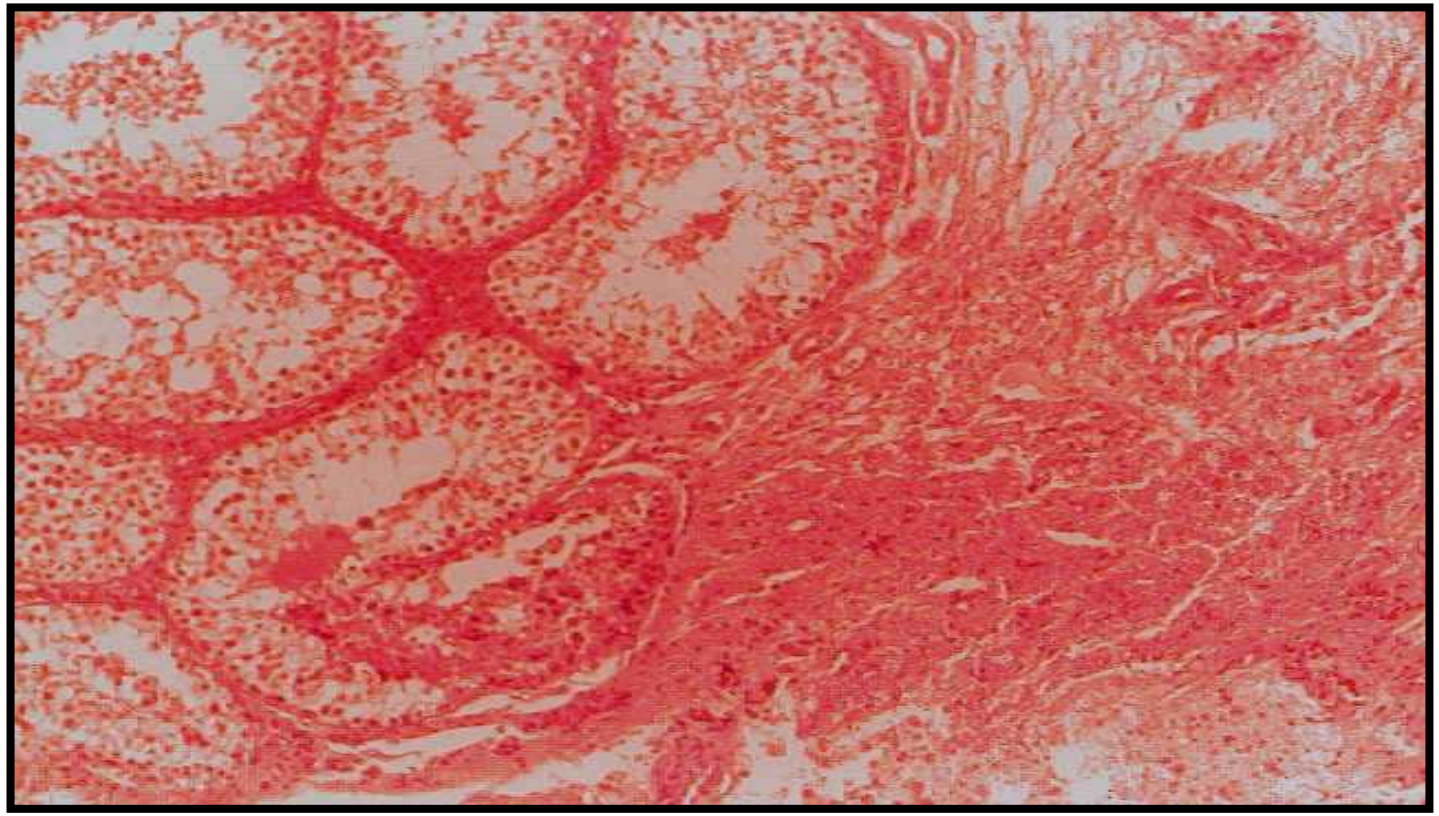
Figure 2. Desirable front and rear leg structure.

- This spraddle-legged sow had a poor foot and leg conformation and is now a serious problem as she cannot get up on her own.
- 这头母猪趾蹄结构不良，出现八字腿，不能站立，成为严重问题



Brucellosis
布氏杆菌病

JEV
日本脑炎



Dry, flaky, “ichthyosis” (fish-scale) skin lesions. Severe biotin deficiency. Hebei.
干燥，起皮，鳞癣（鱼鳞）皮肤病变，严重生物素缺乏症，河北

Dry, scaly, whitish-gray “ichthyosis” dermatitis due to biotin deficiency and secondary bacterial infection with Streptococci. Liaoning province.
生物素缺乏导致干燥，鳞片状，白灰色鳞癣皮炎，继发链球菌性感染，辽宁省

Beginning of recovery after 11 days supplementation with 500 ppb biotin in gestation diet.
Old dead ichthyotic skin peeling off revealing healthy pink skin beneath.
妊娠日粮添加 500 ppb 生物素 11 天后开始好转，旧的鳞癣死皮脱落后露出下面的粉色皮肤

Yongning, Beijing municipality. 北京永宁

Complete recovery after 30 days supplementation with 500 ppb biotin in gestation diet. Some fly bites are visible on otherwise healthy skin. No visible ichthyosis.
妊娠日粮添加 500ppb 生物素 30 天后皮肤完全康复，除了蚊蝇叮咬痕迹外很健康。鳞癣消失

Yongning, Beijing municipality. 北京永宁

Antioxidants 抗氧化剂

Vitamin C (ascorbic acid) 维生素 C （抗坏血酸）

- improvement in general appearance 总体外观改善
- leg straightening 腿更直
- pigs can synthesize VC but perhaps not enough.

猪体内可以合成维生素 C 但是不够

Polyphenols 多酚类

Extracts of various plants 各种植物提取物

Vitamin E *Se* 维生素 E 硒

Selenium 硒

0.3 ppm as Selenite 亚硒酸

0.2 ppm as Organic Se (se yeast or selenomethionine) 有机硒 (酵母，蛋氨酸）

Vitamin E 80 to 150 ppm 维生素 E

出血性胃溃疡
这些溃疡与饲料粉碎太细有关，
饲料粒度直径应为 600 至 800 微米才会有最佳饲料效率并可以避免溃疡发生。

Bleeding gastric ulcer in pars esophageal.
These ulcers are associated with feeds too finely ground.
Feed should be ground at 600 to 800 microns
for best efficiency and avoidance of ulcers.

Urine pH 尿液 pH 值

Normal pH 5.5 - 6.5 正常值应为 5.5 - 6.5 之间

Abnormal >7 大于 7 则不正常

碱性尿液利于细菌生长

碱化日粮

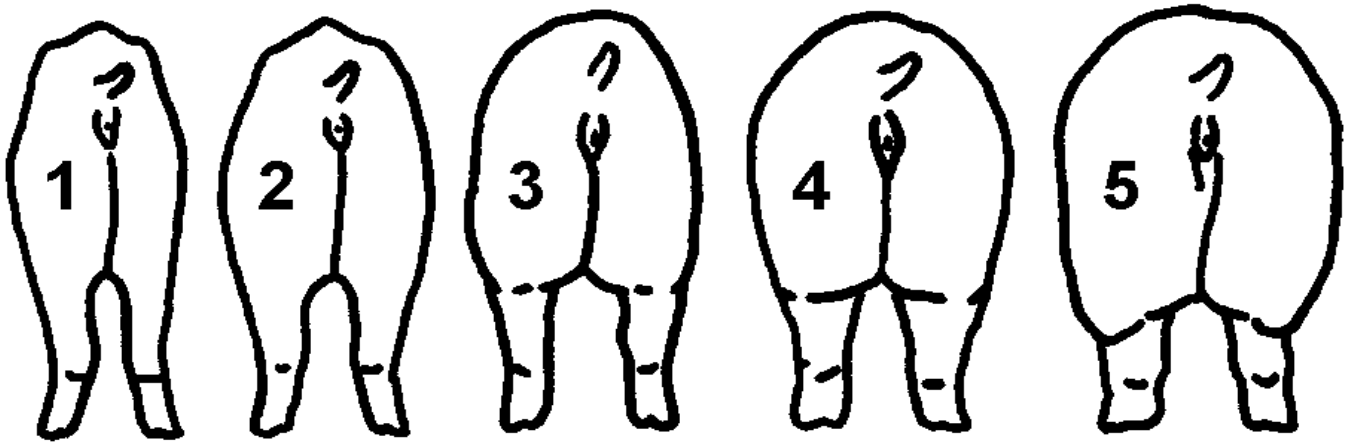
碳酸氢钠

可通过氯化铵修正，每吨添加 3 千克

母猪和公猪— 750 to 1000 ml / 分钟
怀孕母猪： 8 至 12 升每天
哺乳母猪： 8 至 25 升多每天

Body Condition Scores

< 15 mm (< 0.6 in)	15-18 mm (0.6-0.7 in)	18-20 mm (0.7-0.8 in)	20-23 mm (0.8-0.9 in)	> 23 mm (> 0.9 in)



Score	Condition	Detection of ribs, back bone, "H" bones, and "pin" bones
1	Emaciated	Obvious
2	Thin	Easily detected with pressure
3	Ideal	Barely felt with firm pressure
4	Fat	None
5	Overly fat	None

Boar Power (Insemination)　公猪力（输精）

Semen quality　精液品质
Heat detection　发情检测
Frequency of Matings　配种频次
Number of matings per Estrus (service)　情期配种次数

Man Power　人力
Do not force the sow　不要强迫母猪
Farrowing Index = Total pigs born / Number of sows serviced
"Let the data teach you..."
分娩指数 == 总产仔数 / 配种母猪数　“让数据说话 ...”
Insemination - get semen in the oviduct before ovulation.
输精 --- 让精液在母猪排卵前到达输卵管

Semen Evaluation 精液品质评价

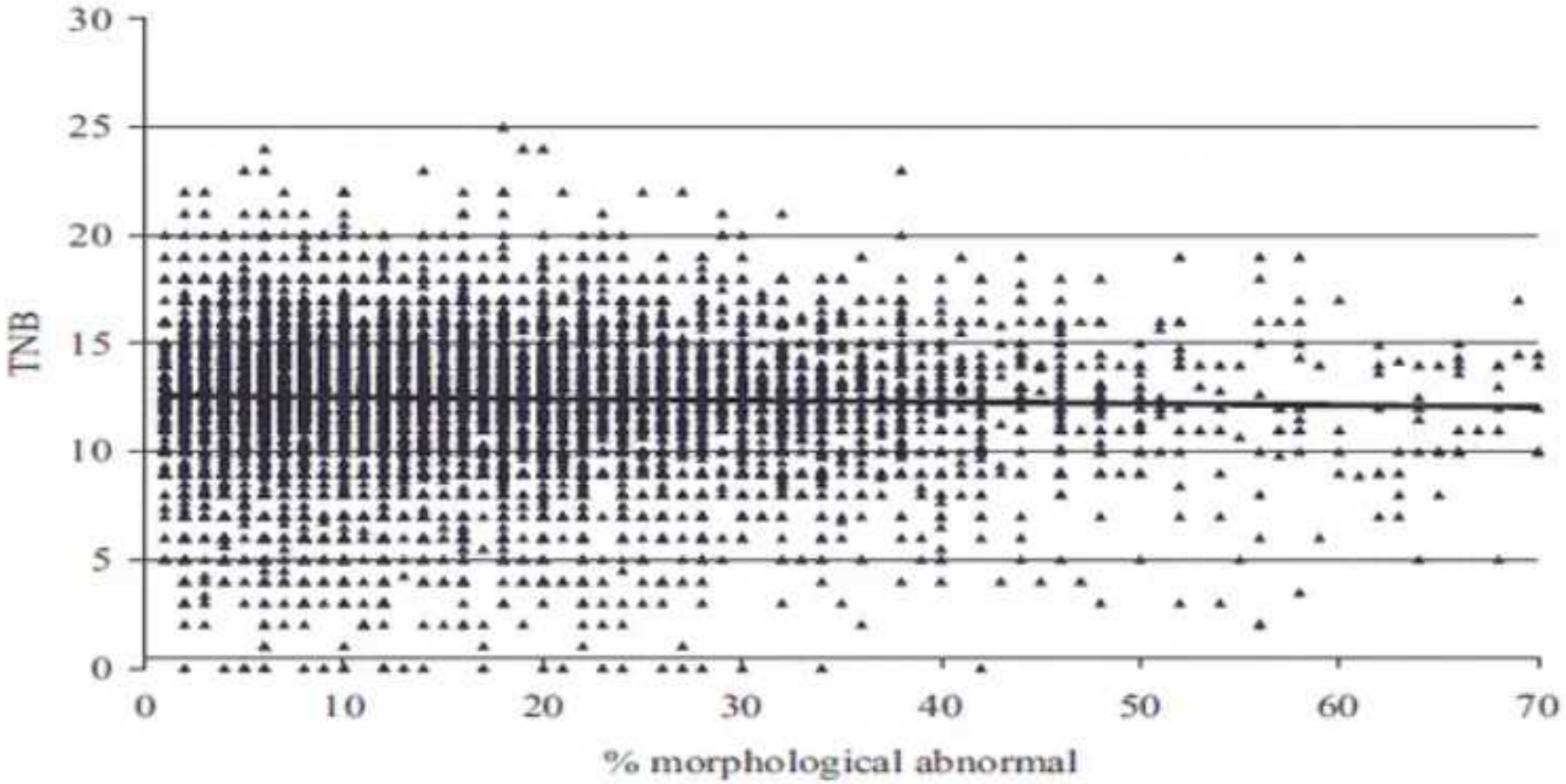
Seminal volume 精液量

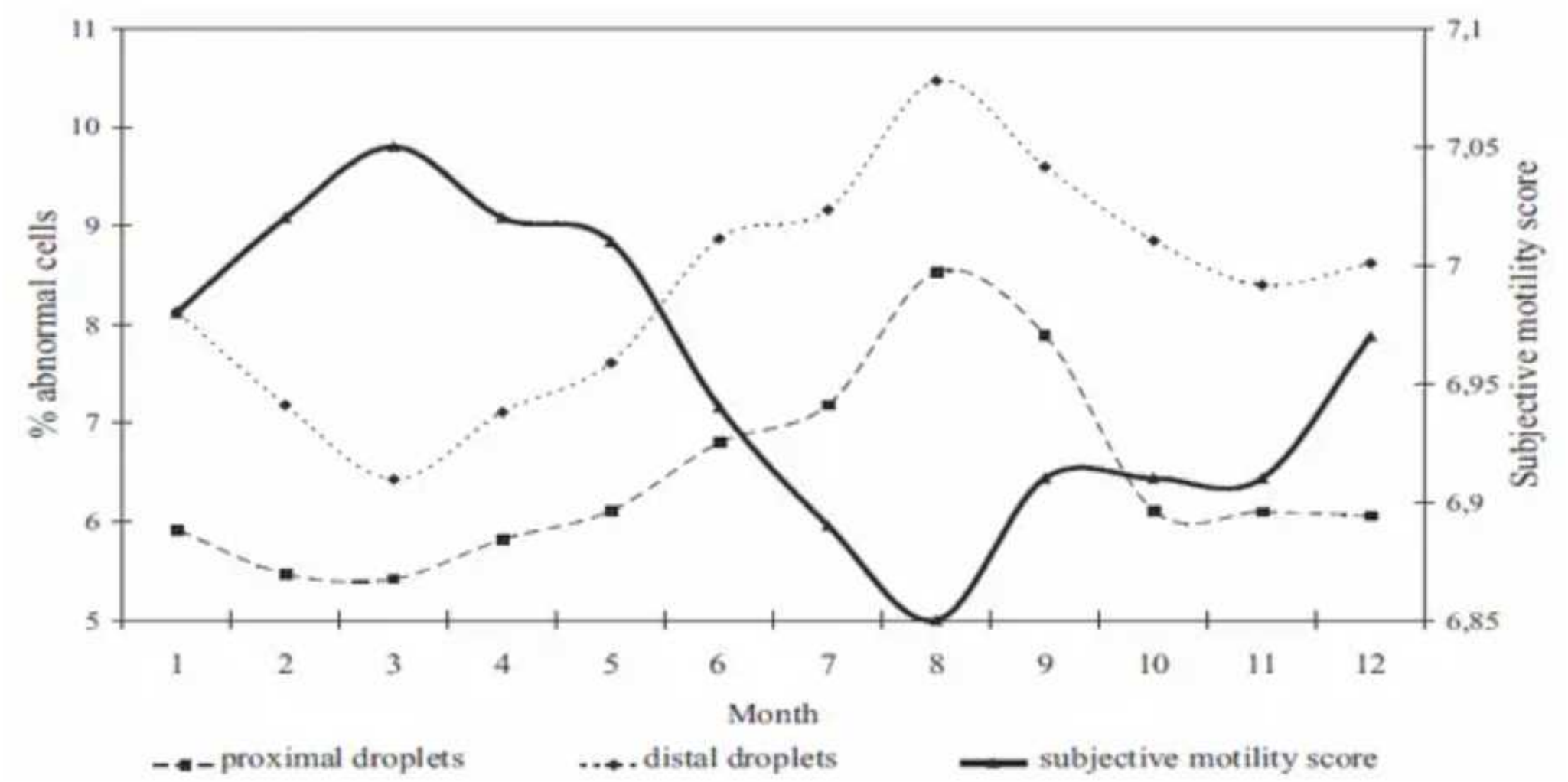
Sperm Concentration 60 to 80 billion sperm total
精子浓度， 600---800 亿总精子数

% Motility % 死亡率

Normal Morphology 75%+ 正常形态 75%+

Detached heads, bent & coiled tails, broken tails, twin heads, twin tails, droplets
头部分离，尾部弯曲卷曲，断尾，双头，双尾，水滴形


30
25
20
15
10
5
0
TNB
0
10
20
30
40
50
60
70
% morphological abnormal


% abnormal cells
11
10
9
8
7
6
5
7,1
7,05
7
6,95
6,9
6,85
Subjective motility score
1
2
3
4
5
6
7
8
9
10
11
12
Month
proximal droplets
distal droplets
subjective motility score

True Fertility 真实繁殖力

The Results 结果

Total Pigs Born/Pigs Born Alive 总产仔数 / 总活仔数

Conception Rate / Pregnancy Rate / Farrowing Rate
受胎率 / 妊娠率 / 分娩率

Farrowing Index (Farrowing rate x Pigs born live)
分娩指数（分娩率 x 活仔数）

Pigs born per 100 services. 每一百次配种的产仔数

True Fertility - Differentiating Boars with Normal Semen

真实繁殖力 - 用正常精液区分公猪

The Results 结果

Farrowing Index (Farrowing rate x Pigs born live)
分娩指数（分娩率 x 活仔数）
Pigs born per 100 services. 每一百次配种的产仔数

Single Boar Matings 单一公猪配种次数

In-Vitro Estimations. 体外法估算

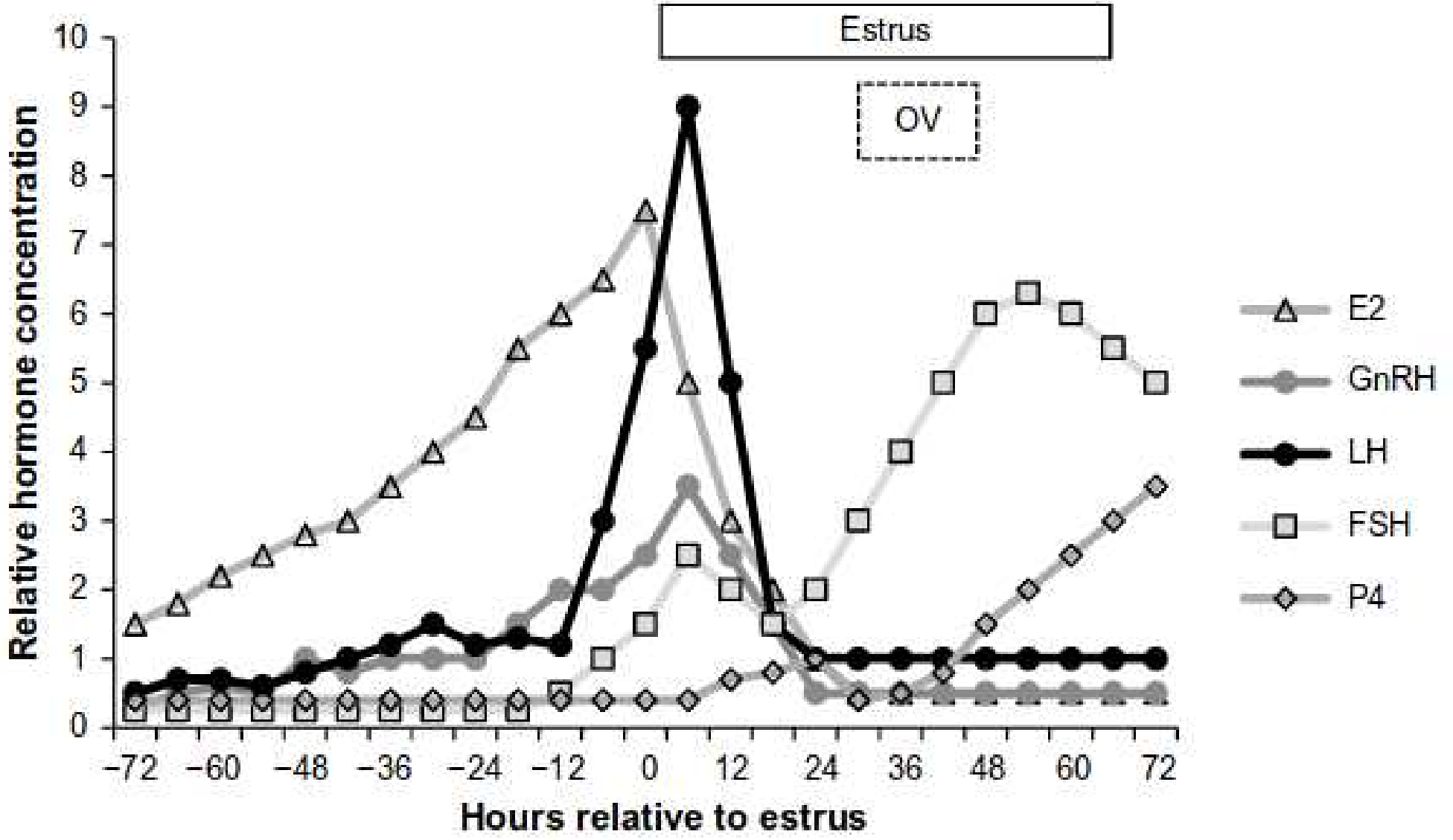
Boar Power (Insemination)　公猪力（输精）

Man Power 人力

Heat Detection USE a BOAR
Do not force the sow 不要强迫母猪

Farrowing Index = Total pigs born / Number of sows serviced
"Let the data teach you..."
分娩指数 == 总产仔数 / 配种母猪数 “让数据说话 ...”
Insemination - get semen in the oviduct before ovulation.
输精 --- 让精液在母猪排卵前到达输卵管

Estrus and Ovulation 发情和排卵



Boar Power (Insemination)　公猪力（输精）

Frequency of Matings 配种频次
Number of matings per Estrus (service) 情期配种次数
North Europe 1.5 x /heat　Spain 2.5 + x / heat
　　北欧 1.5 次 / 情期，西班牙 2.5+/ 情期
Dosage　剂量
More semen, more frequently, more pigs, more often (chance of success). "Close Enough?"
　　更多精液，更高频次，更多仔猪，更高成功几率，“够好了吗”
Farrowing Index = Total pigs born / Number of sows serviced
　　分娩指数 --- 总产字数 / 配种母猪数

Boar Power (Insemination)　公猪力（输精）

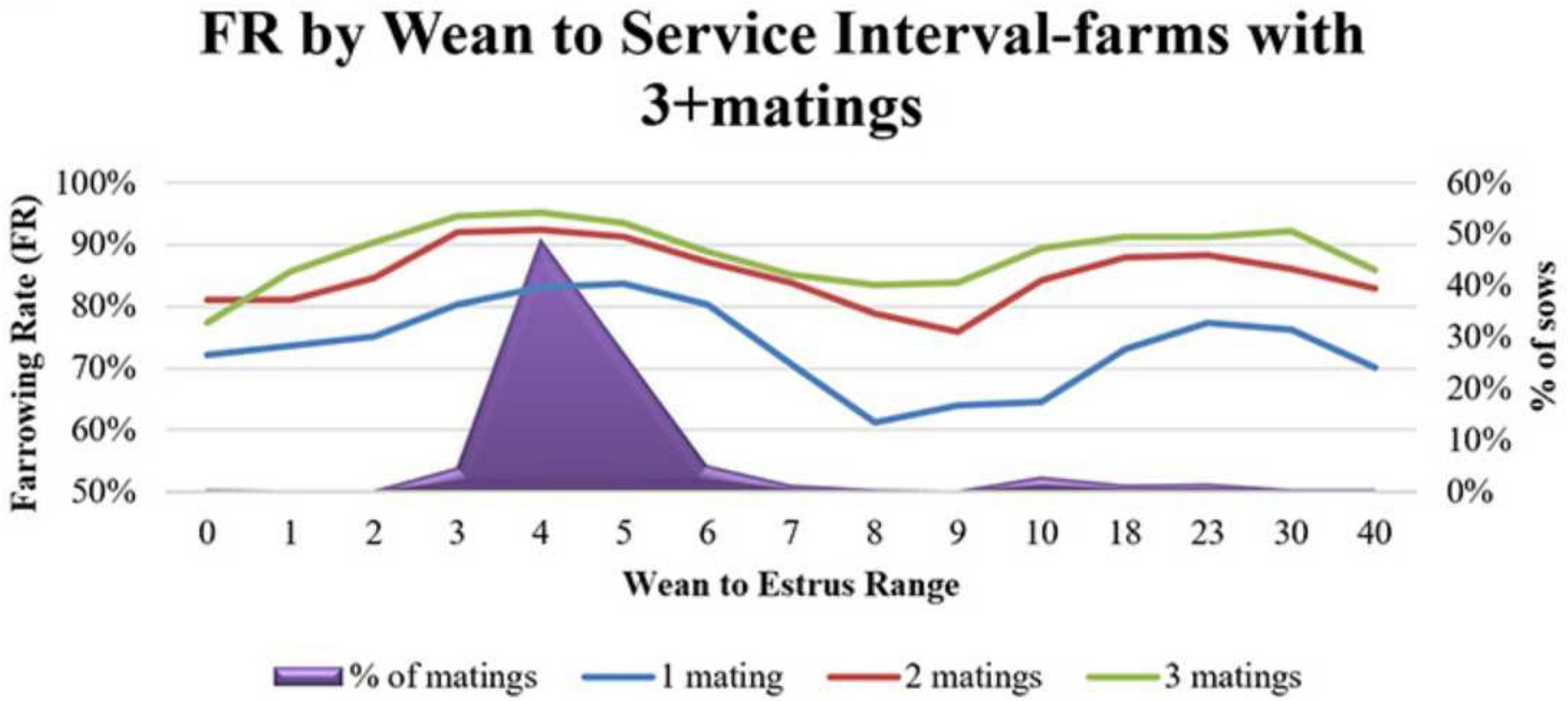
Man Power 人力

Do not force the sow 不要强迫母猪

"Let the data teach you..."
分娩指数 == 总产仔数 / 配种母猪数 “让数据说话 ...”

Insemination - get semen in the oviduct before ovulation.
输精 --- 让精液在母猪排卵前到达输卵管

断奶到配种期间 --- 配种三次以上的场的分娩率



Ketcham, et al 2019

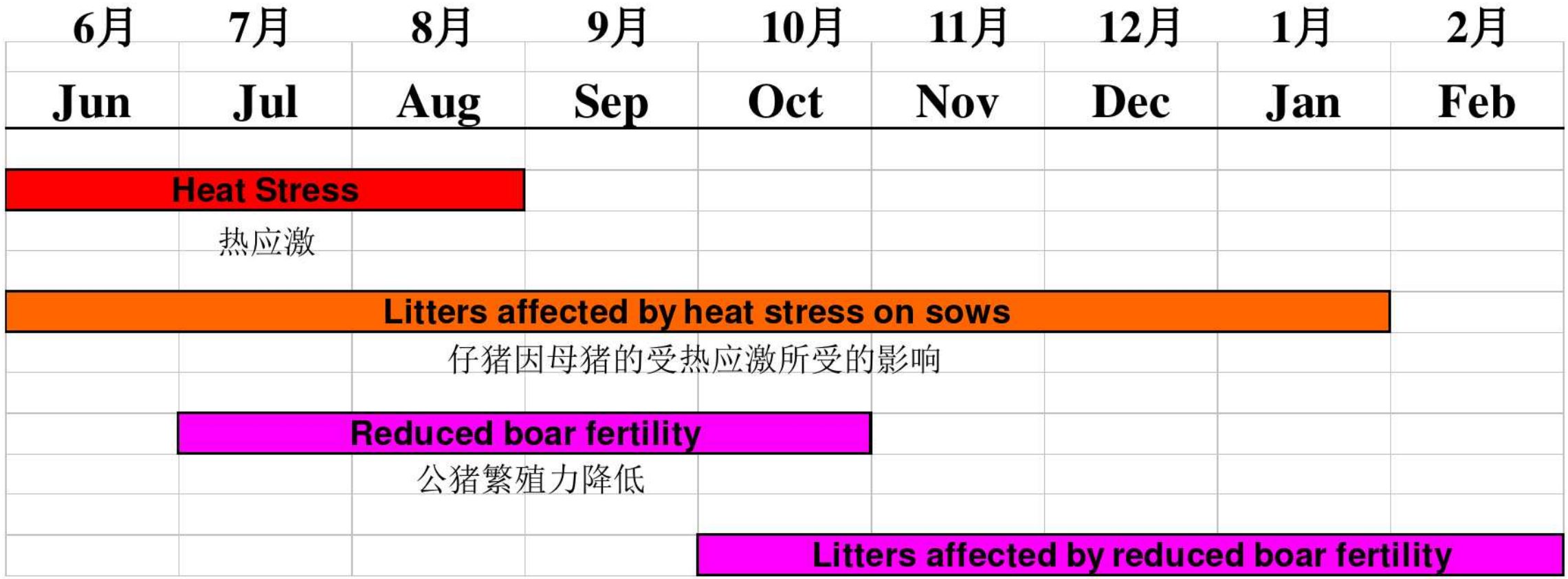
Boar Power (Insemination)　公猪力（输精）

Farrowing Index = Total pigs born / Number of sows serviced

"Let the data teach you..."
分娩指数 == 总产仔数 / 配种母猪数 “让数据说话 ...”

Insemination - get semen in the oviduct before ovulation.
输精 --- 让精液在母猪排卵前到达输卵管

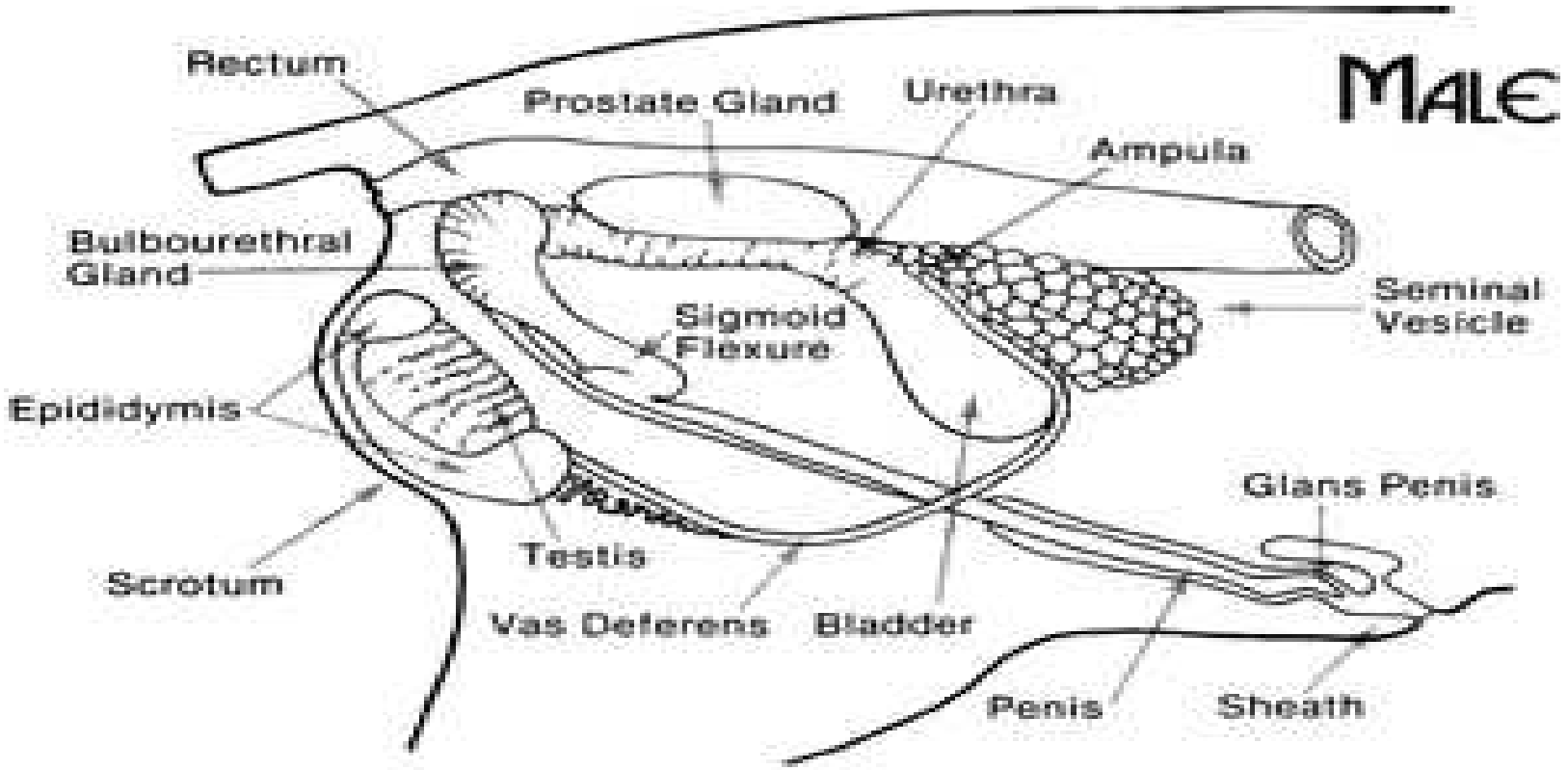
Heat Stress and the Breeding Herd
热应激与繁殖群

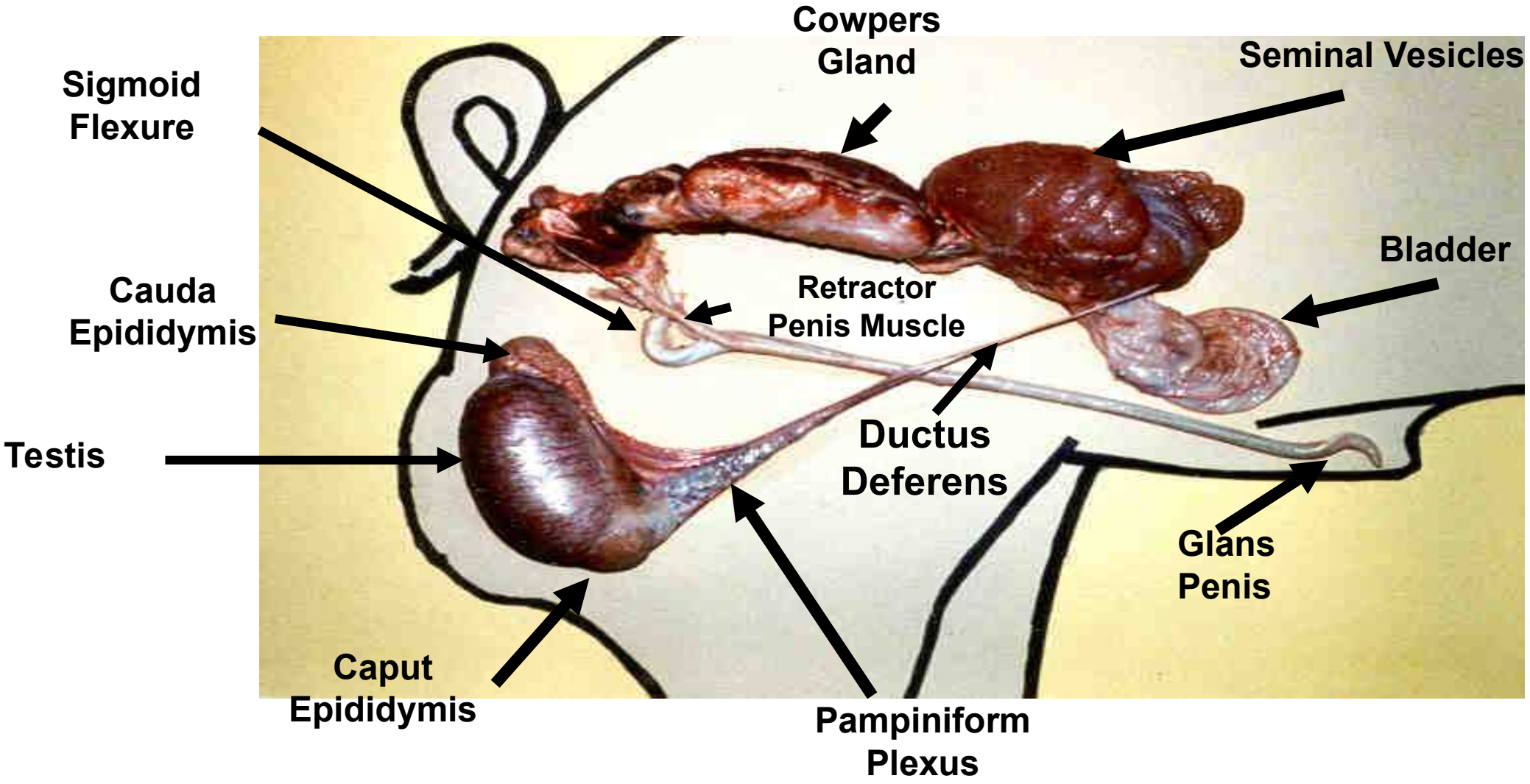


Don Levis, 1980

Scrotum regulates testes temperature to be ~3.5° F (2° C) lower than body temperature.

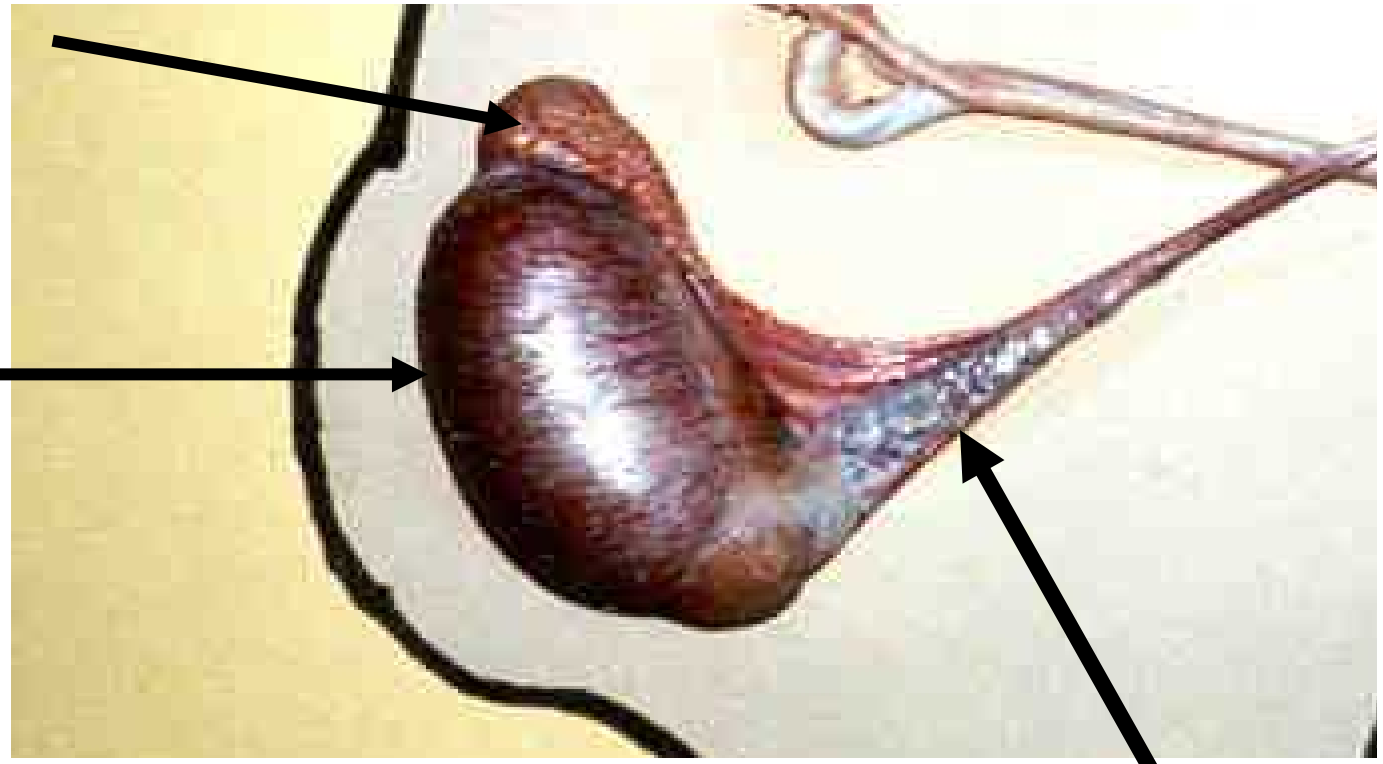
阴囊调节睾丸温度，使其低于体温 3.5°F 或者 2℃ 。




Cowpers Gland
Seminal Vesicles
Sigmoid Flexure
Bladder
Cauda Epididymis
Retractor Penis Muscle
Testis
Ductus Deferens
Glans Penis
Caput Epididymis
Pampiniform Plexus

Cauda Epididymis

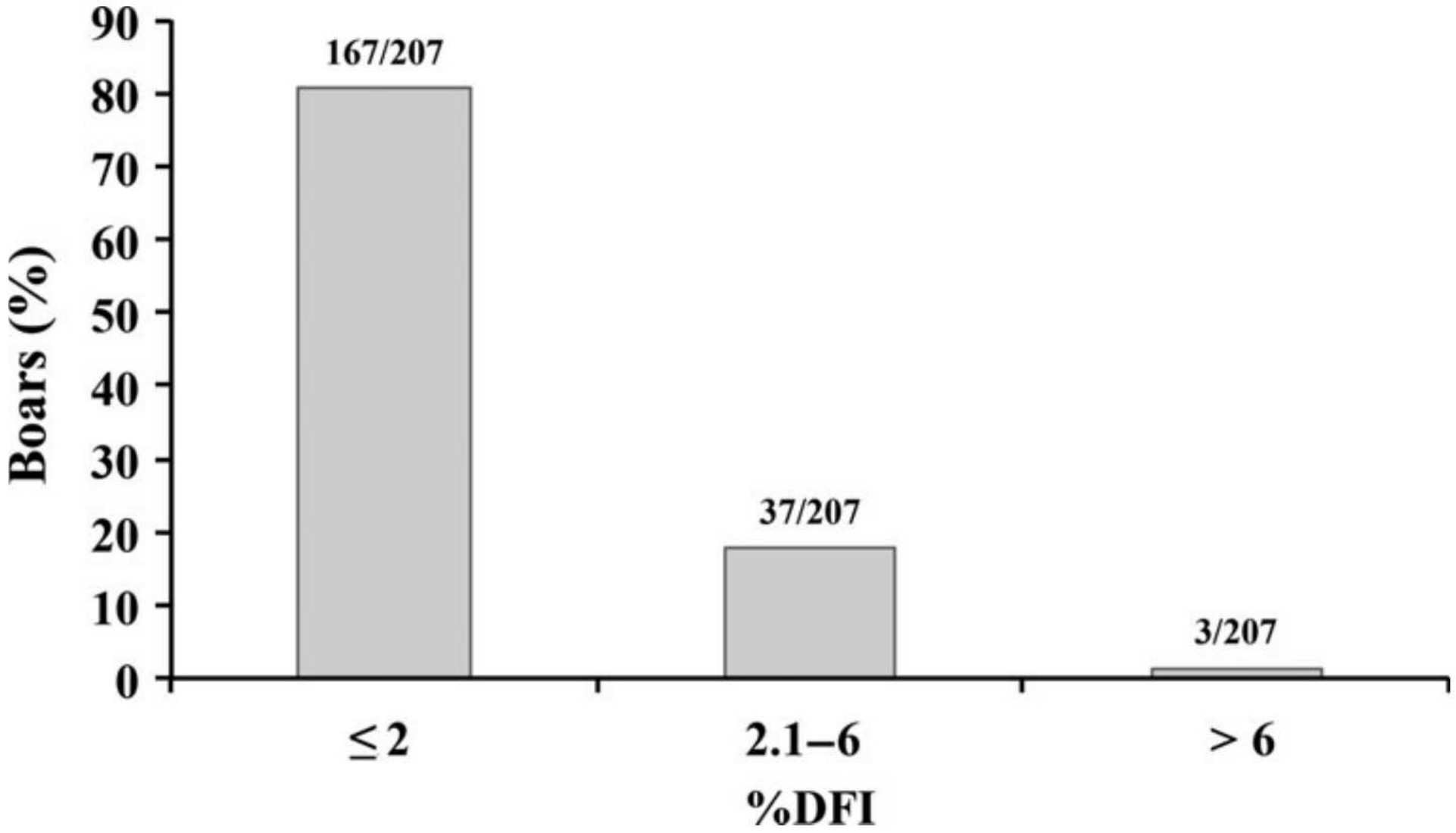
Testis

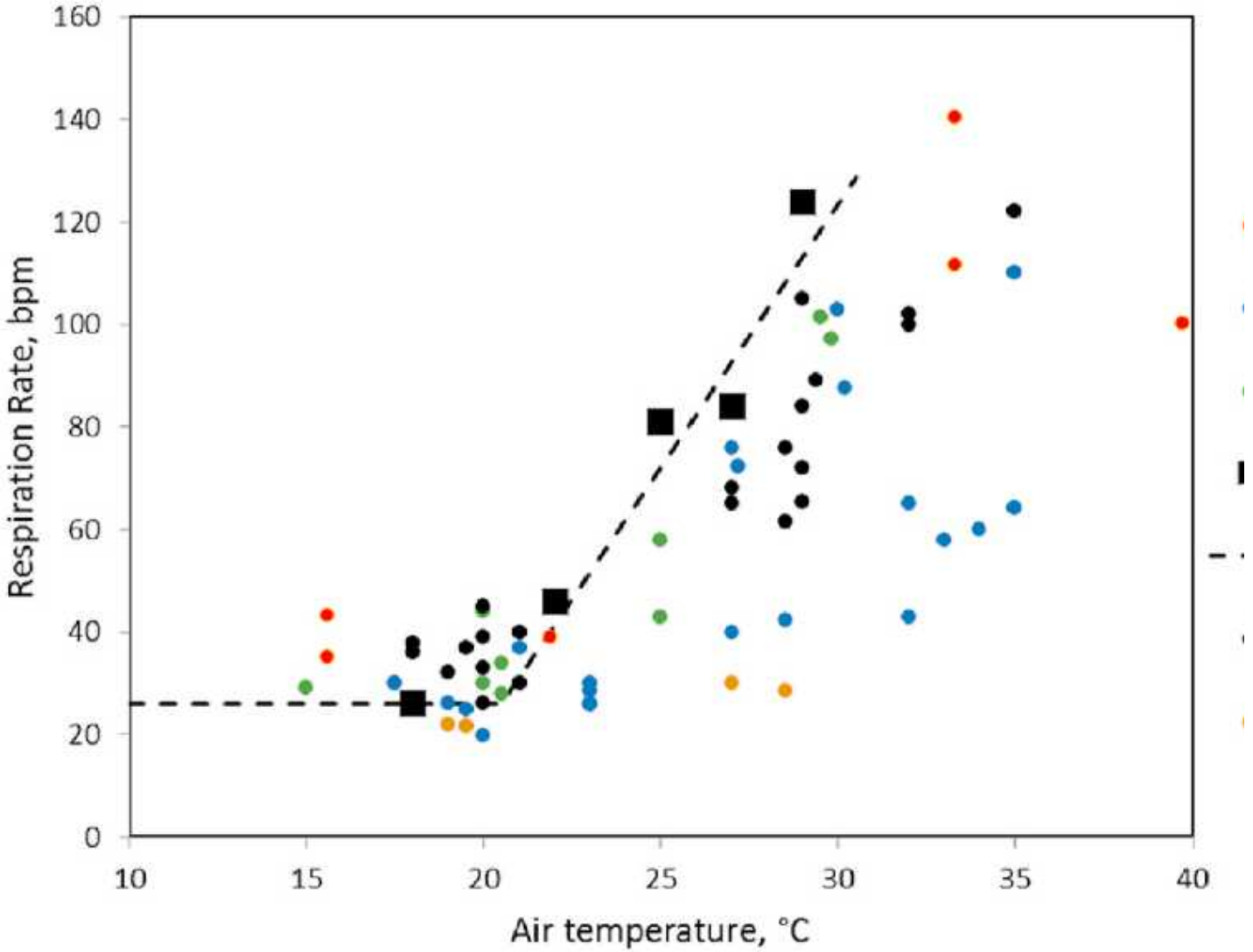


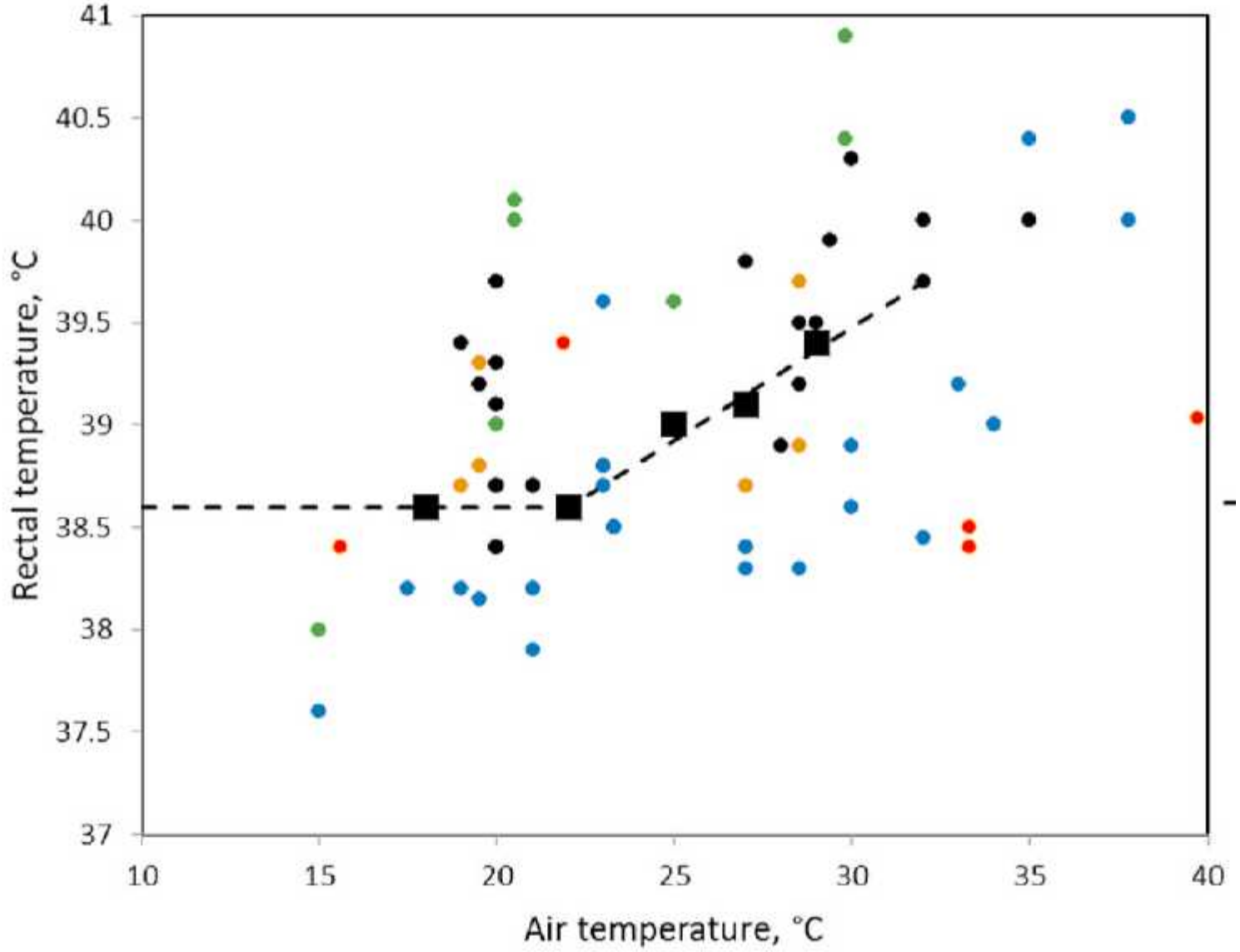
Pampiniform Plexus

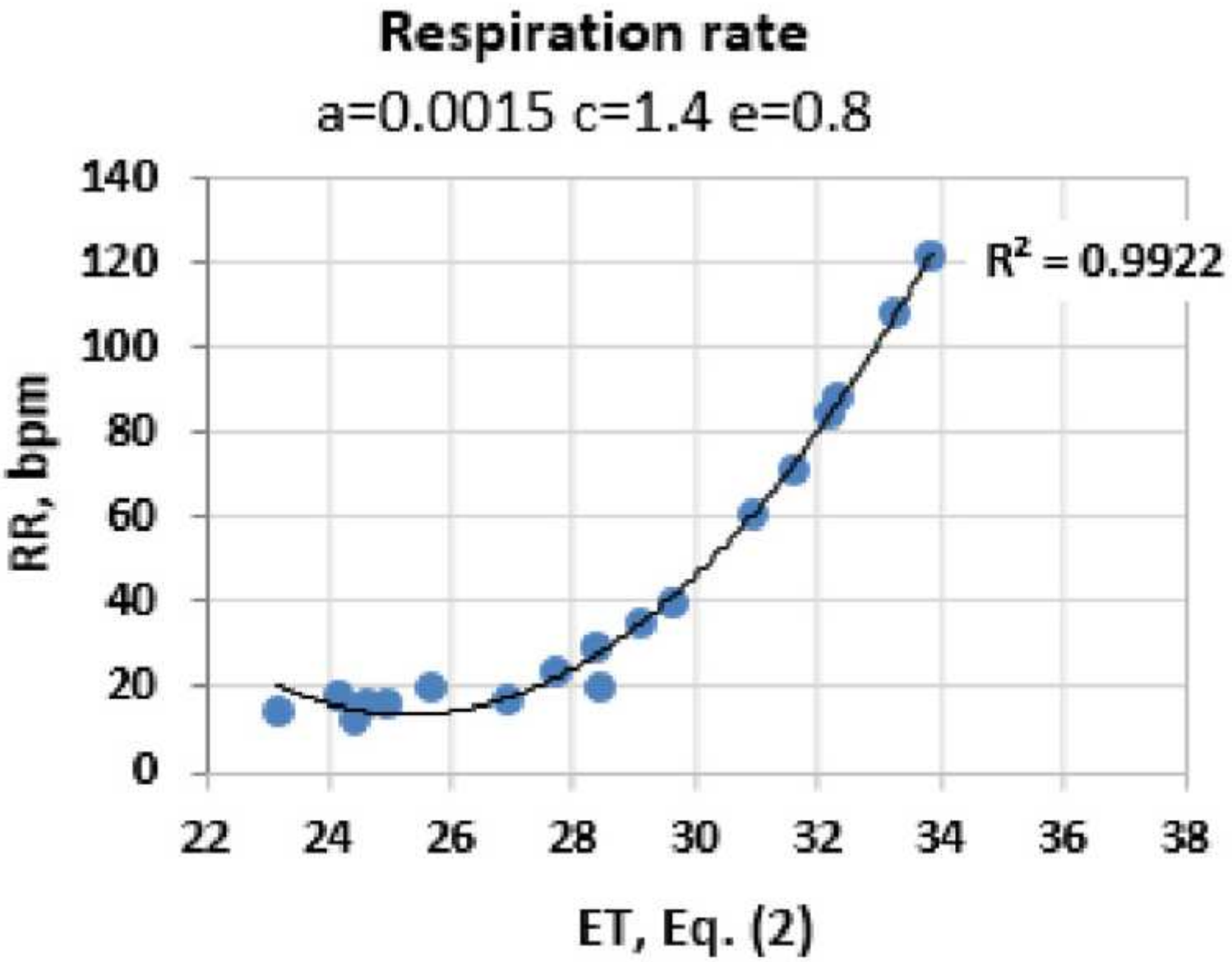
盘状神经丛

DNA Fragmentation Index　DNA 片段指数

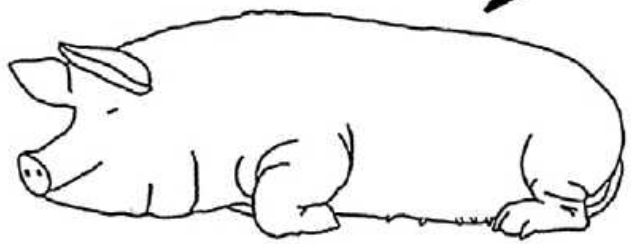


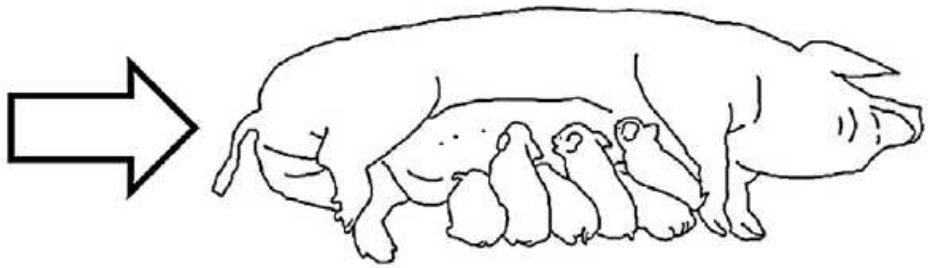

160
140
120
100
80
60
40
20
0
Respiration Rate, bpm
10
15
20
25
30
35
40
Air temperature, °C


41
40.5
40
39.5
39
38.5
38
37.5
37
Rectal temperature, °C
10
15
20
25
30
35
40
Air temperature, °C


Respiration rate
a=0.0015 c=1.4 e=0.8
140
120
100
80
60
40
20
0
RR, bpm
R^2 = 0.9922
22
24
26
28
30
32
34
36
38
ET, Eq. (2)

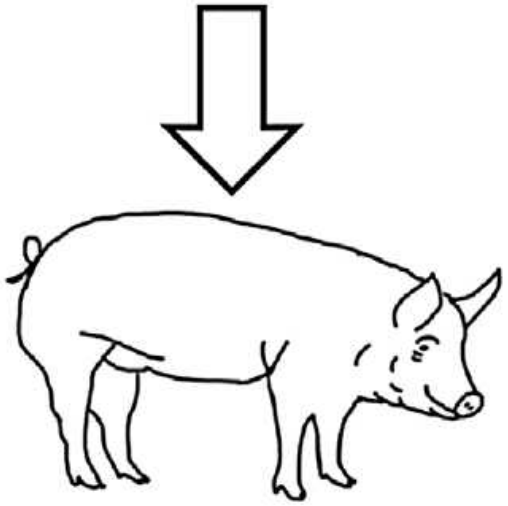
Heat stress





Pregnant sow

- Increased rectal temp
- Increased respiration rate
- Increased skin temp
- Reduced activity
- Changes in body comp
- Lower progesterone
- Shorter gestation
- Lower birth weights



Offspring from *in utero* heat stress (IUHS pigs)

Carryover effects of gestation heat stress on the lactating sow

- Minimal effects on thermobiology
- Insulin resistance during lactation
- Minimal effect on rebreeding

Carryover effects of gestation heat stress on the offspring (IUHS pigs)

- Thermoregulatory ability
- Carcass composition
- Reproduction in gilts– litter size and lactation
- Reproduction in boars – sperm number and quality

-1 PIG BORN
-1 PIG SURVIVED.

Temperature Control
温度控制

Sunshades	遮阴
Ridge Ventilation	屋脊通风
Fans	风扇
Drip or Spray Cooling	滴水或喷雾降温
Evaporative cooling	蒸发致冷
Industrial Air Conditioning	大型空调

Hot Weather - Breeding and Gestation
炎热的天气—配种和妊娠

Spray Cooling or Drip Cooling 喷雾降温或滴水降温

Fans – air velocity 风机-风速

Ridge Ventilation – hot air escapes upward 屋脊式通风-热空气向上逸出

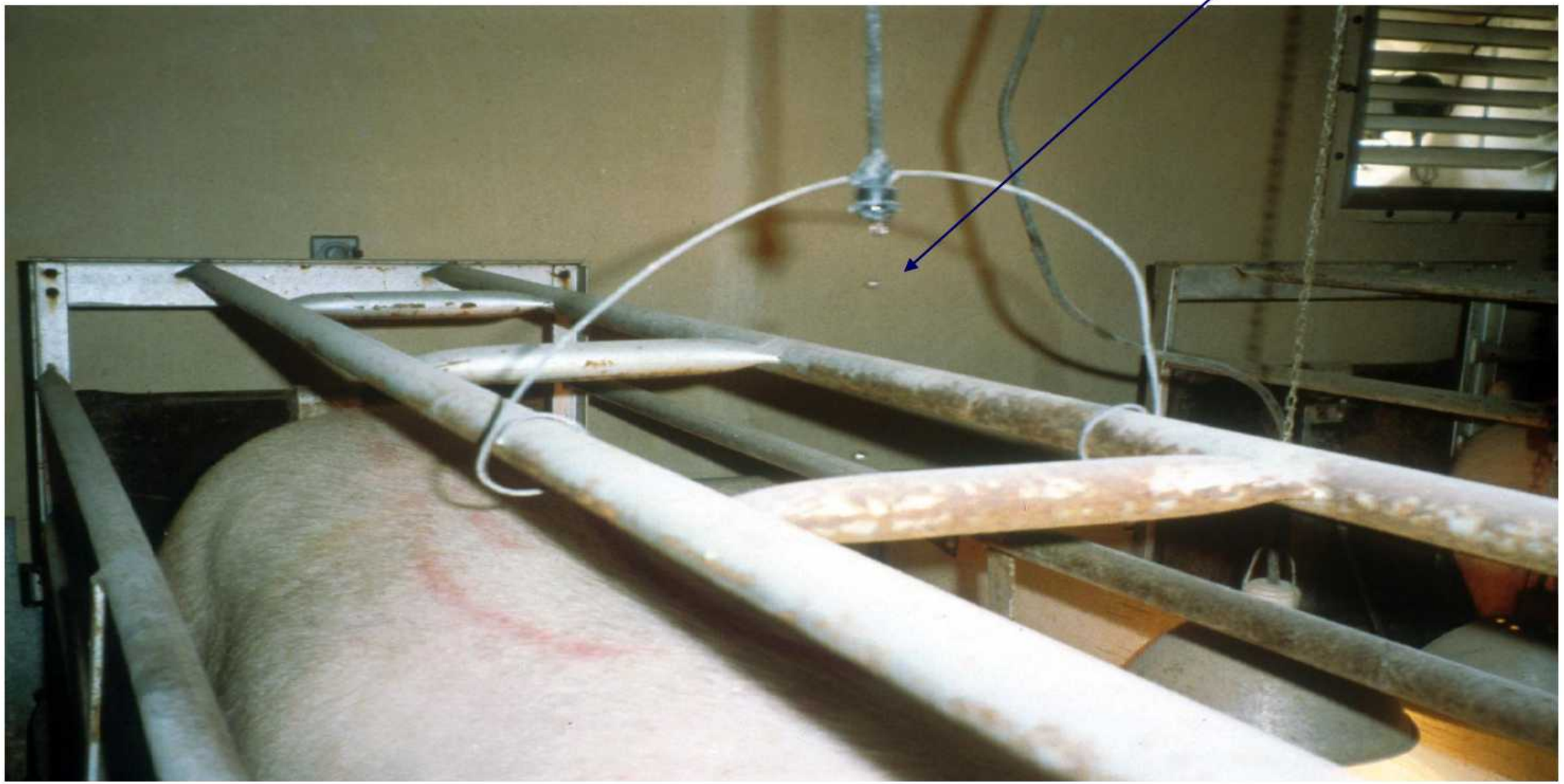
Special needs of boars 公猪的特殊需要

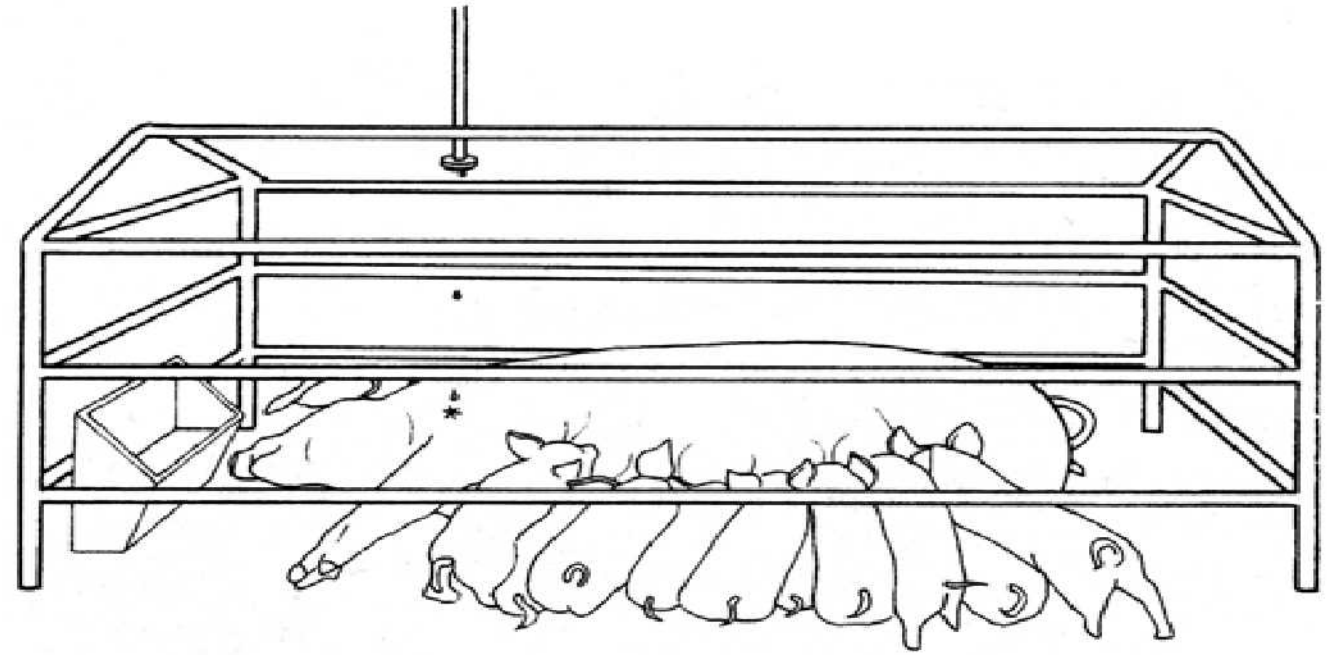
- testicular degeneration 睾丸退性
- sperm quality 精子质量
  - 2 weeks to appear 2个星期后出现
  - 3 weeks to be corrected 3个星期后恢复

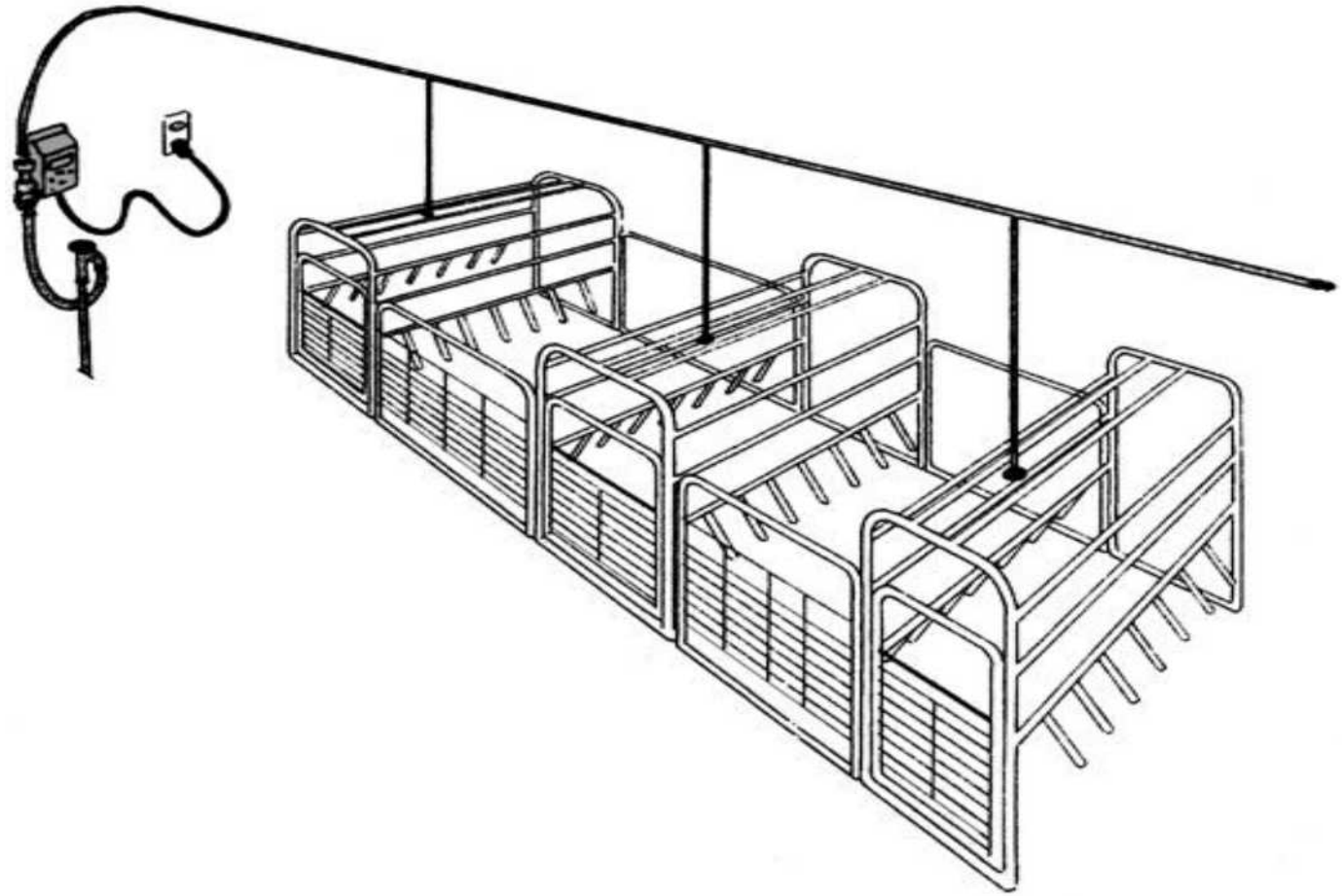
Drip Cooling for Sows
母猪的滴水降温

水滴

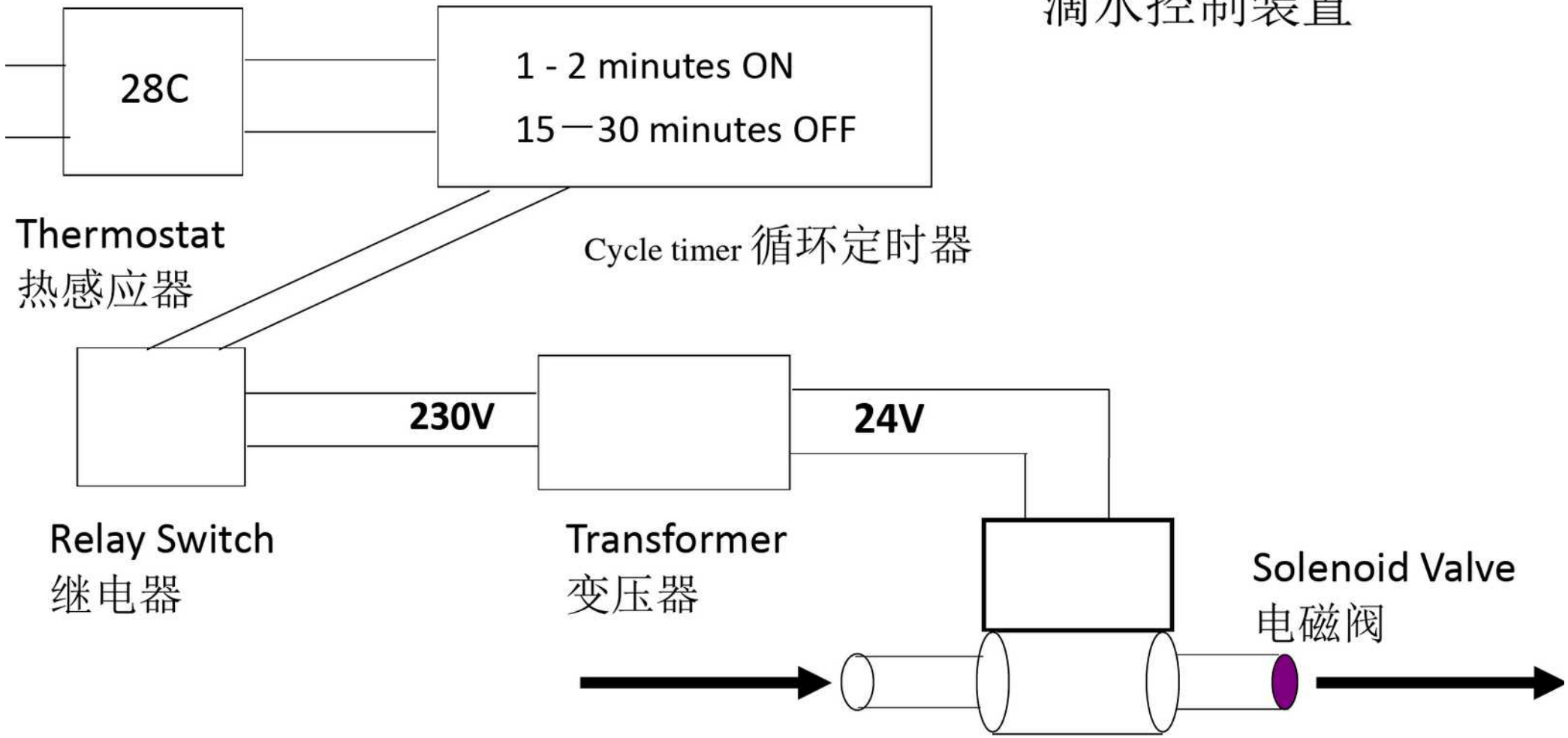
Water droplet



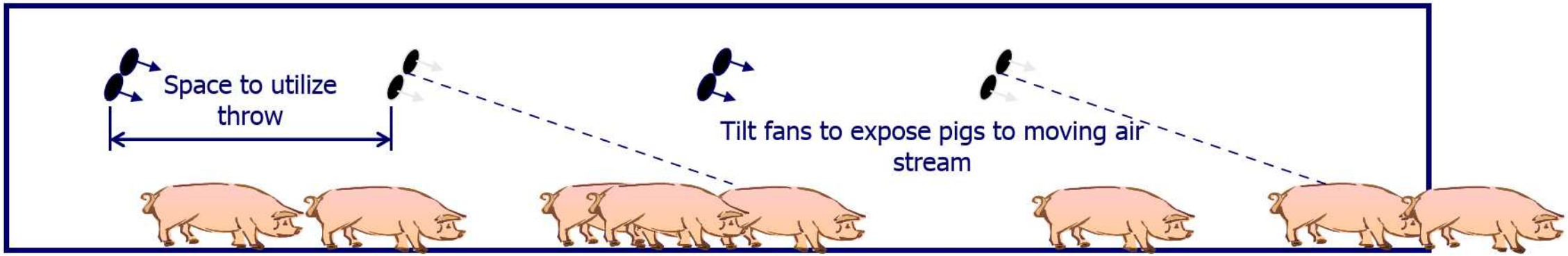




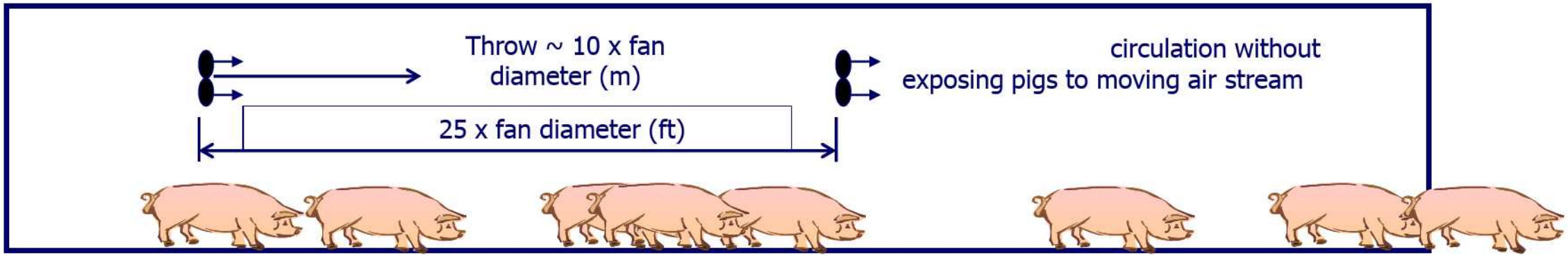
Control Device for Water Drip
滴水控制装置



Fans Used for Supplemental Cooling 降温风扇

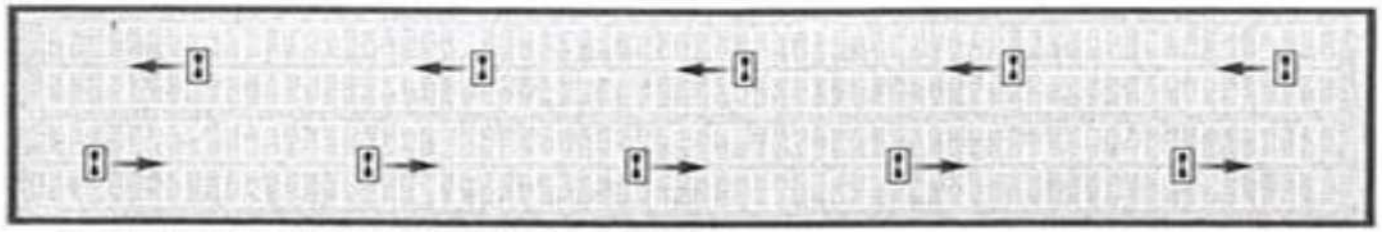


Fans Used for Distributing Air 导流风扇

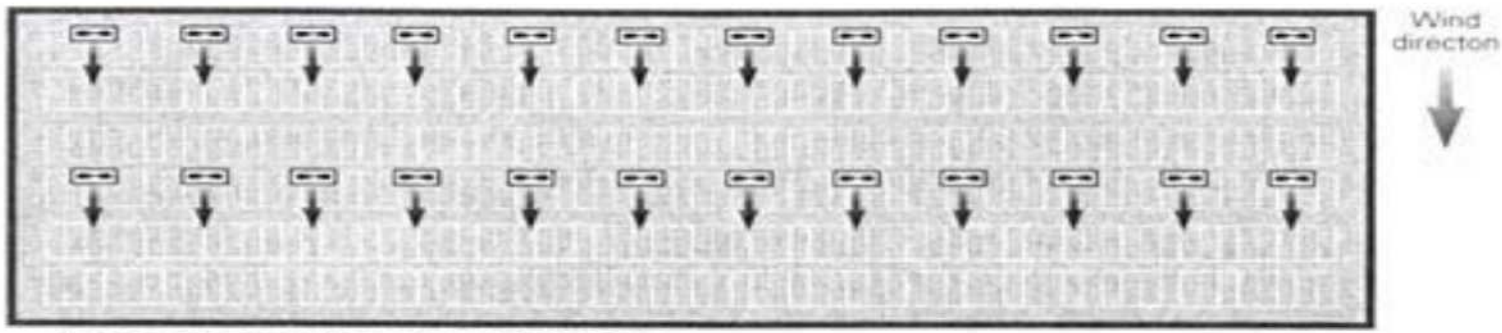


Placement of Stir Fans

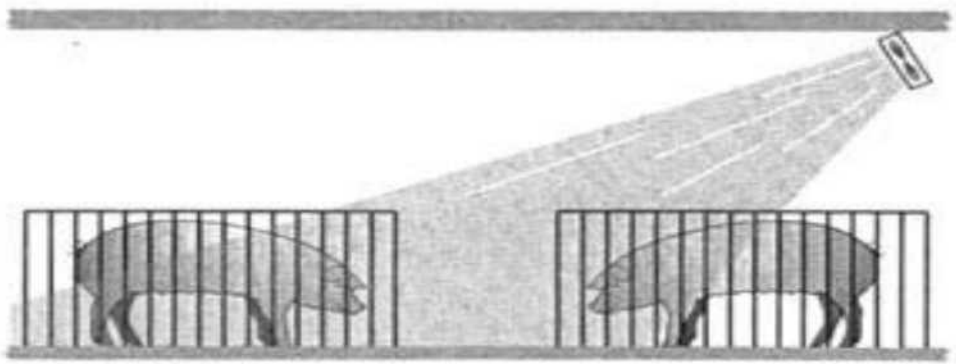
扰流风机布置



a. Race track arrangement of circulation fans.



b. Laterally spaced fans in a wide building.



c. Side view of fan.

Cooling Boars 公猪降温

Keep the scrotum cool 保持阴囊凉爽

Keep room temp below 28 °C 保持室温28 °C 以下

– (consider a/c) 可以考虑用空调。

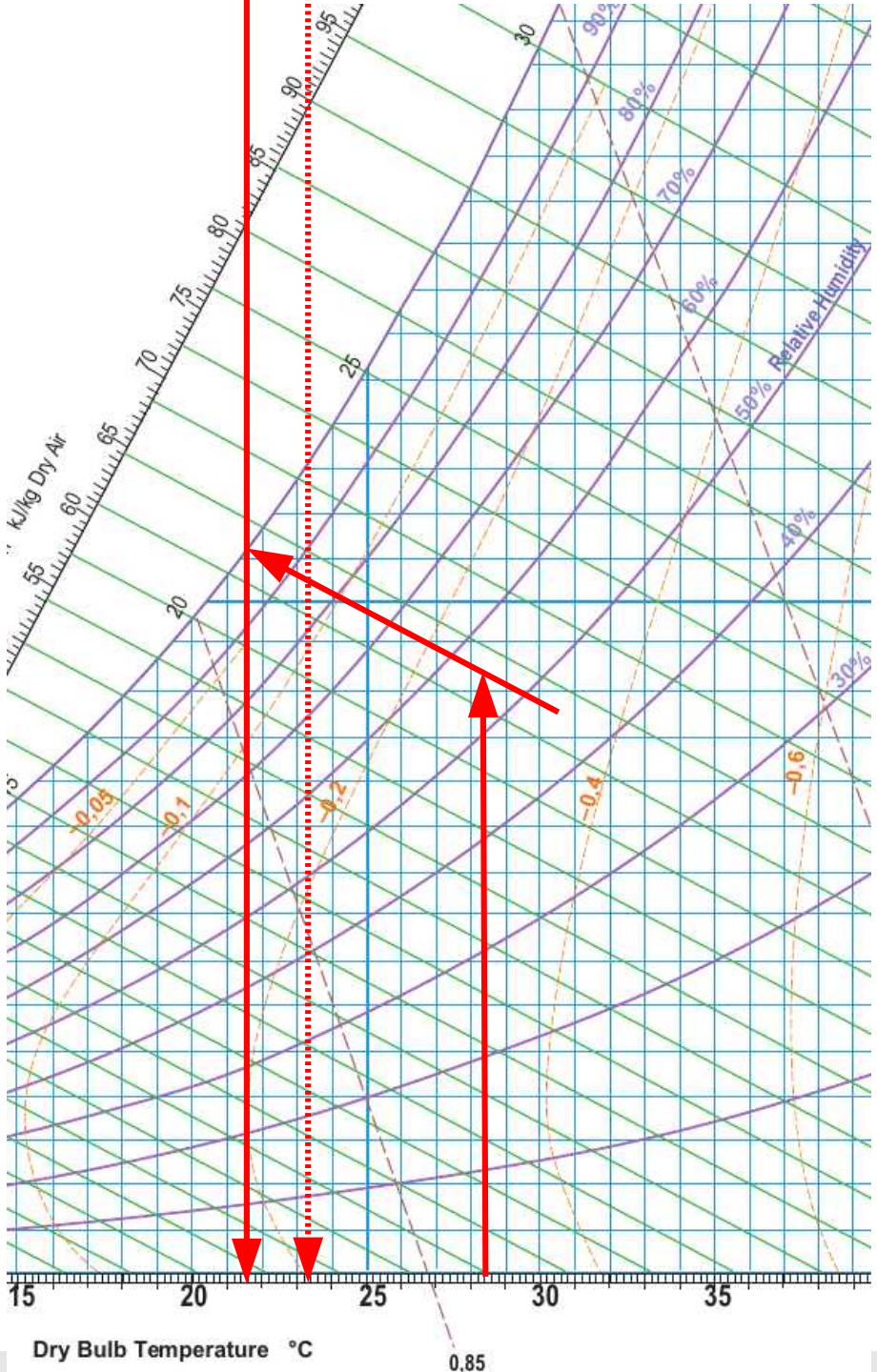
Respiration rate (panting) may not be a good indicator of heat stress

呼吸速率可能不是一个良好的热应激指标。

Evaporative cooling 蒸发散热

The ambient temperature is reduced to the 85% saturation temperature typically. 环境温度被降到 85% 饱和温度

地方	温度 [干球]	湿度	新湿度	湿球温度	85% 饱和度温度	效果
Yunfu	32	82	85	29.2	31	-1.0
Illinois	28.5	70	85	24	26	-2.5
Lanzhou	28.5	55	85			



地方	温度[干球]	湿度	新湿度	湿球温度	85%温度	效果
Yunfu	32	82	85	29.2	31	-1.0
IL	28.5	70	85	24	26	-2.5
Lanzhou	**28.5**	**55**	**85**	**21.5**	**23**	**-5.5**

In Lanzhou the drier and cooler climatic conditions make evaporative cooling much more effective.

Air Conditioning 空调

Reduce temperature 降低温度
Reduce moisture 降低湿度
Reduce ventilation rate 降低通风率

Expensive Equipment 昂贵的设备
Complicated Systems 复杂的系统
High Energy Costs 高能耗

Saves lives of Valuable Animals 挽回了有价值的种用动物的生命
Maintains Fertility 维持了生育率
Prevention of Production Disruption 避免生产损失
Ease Management of Filtered Barns
安装了过滤系统的公猪易于管理

Especially for Pig Farms Air Conditioners 猪场用空调

Emphasis on the dehumidification side 重点在除湿一侧

Recycling of Cold Air to the Condenser 冷空气再循环至冷凝器

Tolerant of Dust and Rough Service 耐灰尘和粗糙保养

Cleanable with Farm Grade Devices 可使用农场级设备进行清洁

Long Life 使用寿命长

Water-cooled condensers 水冷式冷凝器

Chilled Water 冷冻水

Industrial-strength Industry-sized 工业强度，工业规模

Specialty engineering 专业工程

Insulation R-values 保温板R值

	Thickness (cm.) 厚度					
Type种类	**3**	**4**	**5**	**6**	**8**	**10**
White Bead Board白色泡沫板 EPS 白板	4	6	7	9	11	14
Blue Board 蓝板 XPS 聚苯乙烯挤塑泡沫板	6	8	9	12	16	20
Brown Board 棕色板 Polyiso聚异氰脲酸酯板	9	13	16	19	25	31
Fibreglass Batting玻璃纤维棉絮						14

Brick/Concrete砖/混凝土	R 0.8	Steel Panel钢护板	R 0.6
Glass Window玻璃窗	R 0.9	Plastic Sheet塑料片材	R 0.6
Double Glass双层玻璃	R 1.7	Air Space 空气	R 1.0

Desired Insulation Values:期望绝缘值：

Wall： R14 - R16　　Ceiling + Roof : R > 20

墙：R14 - R16　　天花板+屋顶 ： R > 20

Insulating the Boar Barn 公猪舍保温 / 隔热

The cost of insulation is negligible as compared to the cost of loss of boar power

和丧失公猪力的损失比，公猪舍保温的成本几乎可以忽略不计

Insulation keeps heat out 保温层将酷热隔离在外

Insulation keeps heat in 保温层将温暖保留在内

Insulation keeps coolness in 保温层将凉爽保留在内

R-value of 24 is not too much but it is enough for walls and ceilings.

R 值为 24 不算太大，但是对于墙壁和天花板足够了

A couple of small windows at the end of the buildings is enough windows.

圈舍末端留几个小窗户就足够了。

Summary 总结

Evaporating water from skin surface is most effective cooling system for swine.
皮肤表面的水分蒸发，对猪来说是最有效的降温方式。

Water needs to be properly placed and at the correct flow rate.
滴水安置在正确位置，并且水的流速恰当。

Increased air speed & lower humidity greatly increase evaporative heat loss.
空气流速的增加和湿度的降低，可大大加强蒸发降温。

Sprinklers for G-F pigs & drippers for sows.
生长育肥猪喷淋降温，母猪滴水降温。

Fixed Costs - Economy of Scale 固定成本 -- 规模效益

Sunk Costs 一次性投入

- Boar Station 公猪站
- Equipment 设备
- Boars 公猪
- Feed they Eat 饲料
- Medicine 药物
- Electricity 电力
- Technician Collecting Evaluating

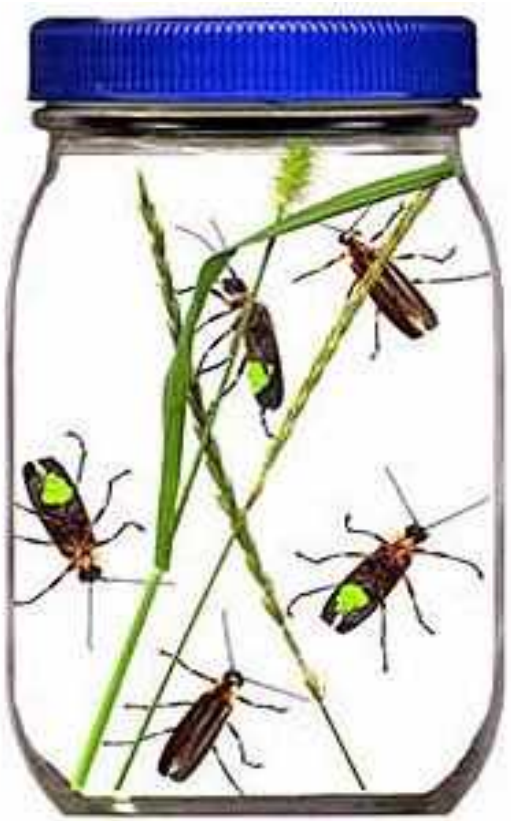
Variable Cost - Expendables 流动性成本 -- 消耗品

Integration 集约化

or 还是

Captive Customer? 专属客户


AGREEMENT
TRUST
COMMITMENT
SUPPORT
INTEGRITY

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