



Equine Metabolic Syndrome

Marc-Andre Blouin

Equine Technical Service Manager





Primary Symptoms EMS

- ✓ Hirsutism, changes in the hair coat with long, curly hair and delayed shedding.
- ✓ Weight loss or muscle wasting.
 - not in all cases of EMS
- ✓ Polyuria or an increase in urine production.
- ✓ Polydipsia or an increase in water consumption.
- ✓ Pot bellied appearance.





Primary Symptoms EMS

- ✓ Laminitis and hoof abscesses
- ✓ Diabetes mellitus
 - high blood glucose
 - Insulin resistance
- ✓ Infertility
- ✓ Chronic infections
- ✓ Cresty neck – abnormal fat deposits





Insulin Resistance

- ✓ State in which a normal concentration of insulin fails to elicit a normal physiological response



Insulin Sensitivity Affected by:

- ✓ Cortisol levels (natural and synthetic)
- ✓ Obesity
- ✓ Meal size
- ✓ High starch and sugar intake
- ✓ Pregnancy
- ✓ Exercise
- ✓ Age
- ✓ Genetics





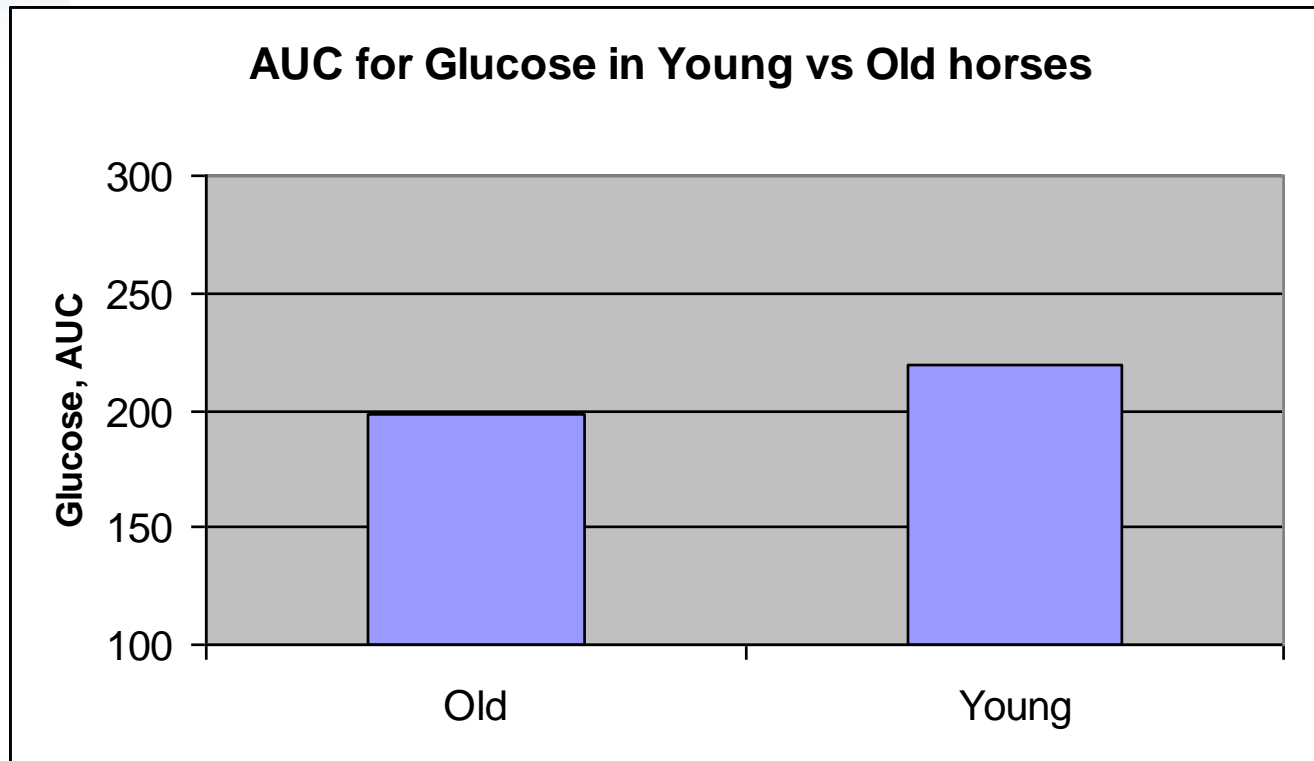
Glycemic response of old or young horses

- ✓ Mich. State Univ.
- ✓ 18 ingredients were tested using 16 horses
- ✓ Trial lasted 16 weeks
- ✓ Normal procedures for glycemic response were used
- ✓ 8 old horses
 - Mean Age - ~14 yrs
 - Mean weight – 1087 lbs
- ✓ 8 young Horses
 - Young horses Mean age - ~3 years
 - Mean weight – 910 lbs





Glycemic response of old versus young horses

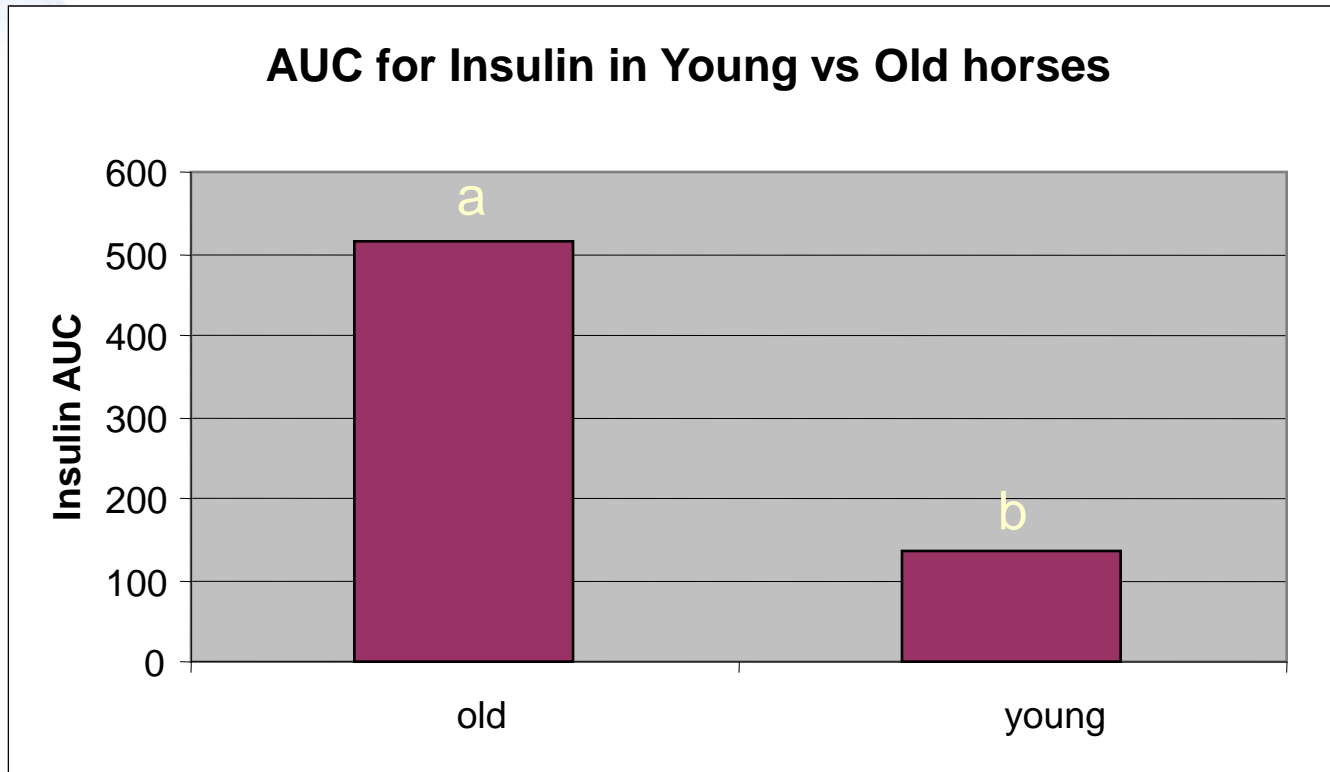


Glucose – No effect





Glycemic response of old versus young horses



Insulin: Old was significantly higher than young, $P < 0.001$





Insulin Resistance Influences:

- ✓ Onset of Laminitis
- ✓ Exertional rhabdomyolysis
- ✓ Osteochondrosis
- ✓ Reproductive efficiency
- ✓ Health status





EMS - 3 Possible Conditions

- ✓ Cushing's Disease
 - No negative feedback for cortisol
 - Cortisol from pituitary
- ✓ Insulin Resistance
 - Obese horse/pony
 - Cortisol from fat cells
- ✓ Stressed horse – could be drug induced
- ✓ Poorly fed horse
 - Not enough nutrition (vitamins & minerals)





Diagnosis & Treatment of Cushing's

- ✓ Dexamethasone suppression test is.
- ✓ Diet
- ✓ Medications of choice are currently Pergolide, a dopamine antagonist or Cyproheptadine. These drugs change the hormone secretion from the tumors and are NOT chemotherapy.





Horse Obesity

(Feedstuffs, July 16, 2007; Research by Virginia-Maryland College of Veterinary Medicine and Virginia Tech University)

- ✓ 51% of horses in a study were found to be overweight or obese
 - BCS greater than 6 = 51%
 - BCS greater between 6 and 8 = 32%
 - BCS of 8 to 9 = 19%
- ✓ Major causes are overeating and lack of exercise
- ✓ In 1998 the number of overweight horses was ~5% (based on an owner survey)





Glycemic-Insulin Dynamics in Horses

Hoffman et al. (2003) JAS 81:2333-2342

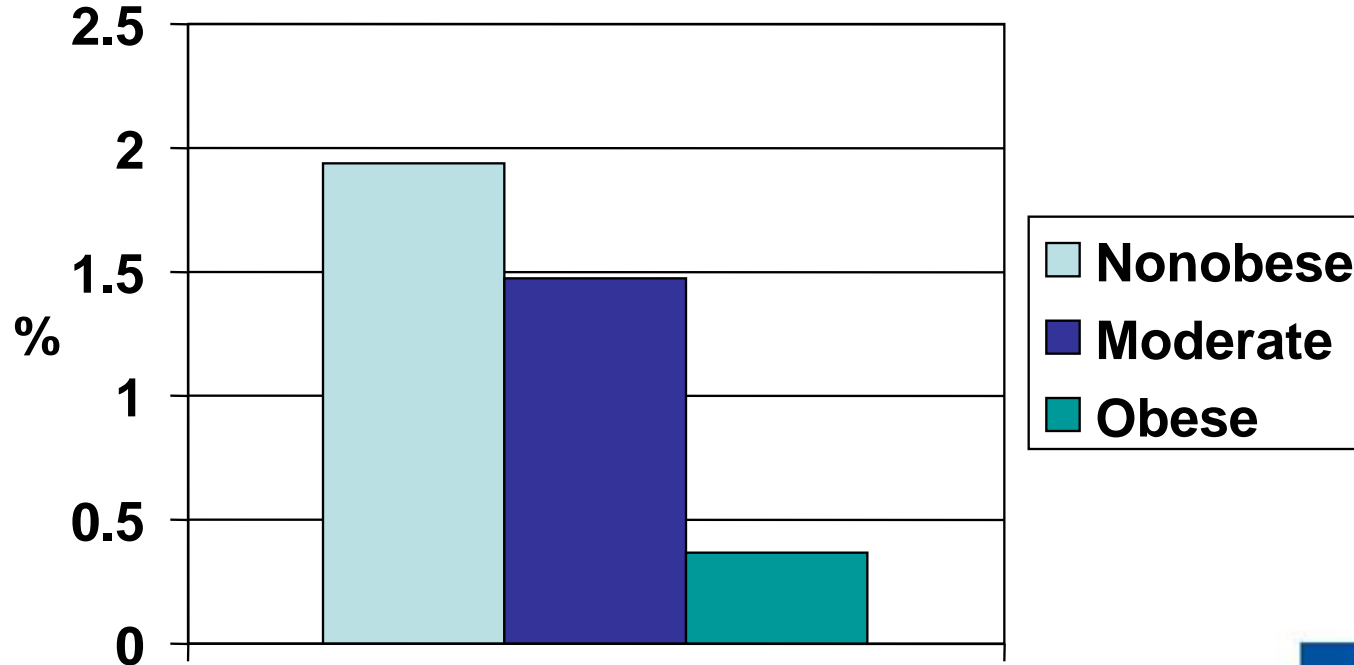
- ✓ Nonobese horses - BSC ~5 to 5.9 (n = 4)
- ✓ Moderately obese - BSC 6 – 6.9 (n = 3)
- ✓ Obese – BSC of 7 to 9 (n = 3)
- ✓ Different diets were used from low starch versus highs starch and sugar





Glycemic-Insulin Dynamics in Horses

Insulin Sensitivity



Obese horses were significantly higher, $P < 0.01$





Cushing – Dietary Treatment

- ✓ Low glycemic feed - Cushing's ONLY
 - Low NSC (total sugar/starches) feed ????
 - NO FEED for FAT horses!!! – Supplement (Equilizer/Optimal) only
 - Small frequent feedings
- ✓ Balanced ration – a must & optimum vitamins and minerals
 - A cup supplement (Equilizer/Optimal)
 - B-vitamins (Horse Plus)
- ✓ Added Fat – essential fatty acids ??
 - 2 cups of ground/boiled flax per day ??





Cushing – Dietary Treatment

✓ Low glycemic hay ???

- < 10% NSC
- low Fructans (sugar) – hay & pasture
- wet hay to remove sugars ??

✓ Chromium ??

- 5 mg / day
- no research
- not registered for horse – suggested not recommended

✓ Magnesium (magnesium oxide)

- 10-15 g/day





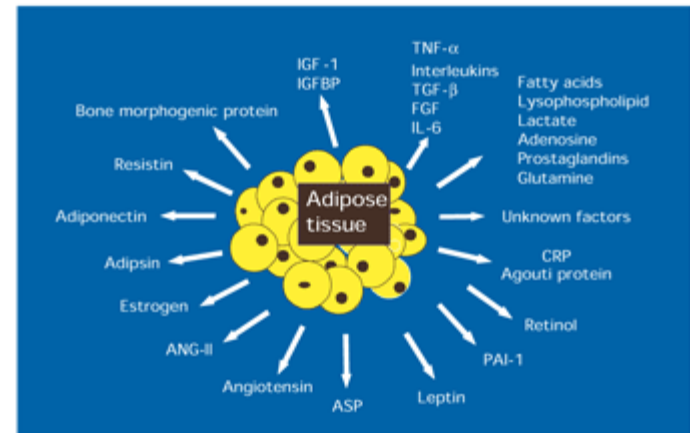
IR – Dietary Treatment

✓ **NO FEED**

✓ Less hay & pasture

- slow eating hay feeders
- muzzle

✓ More saddle time



Figure—Factors secreted by adipose tissue. Adipose tissue is a source of many proinflammatory and proatherogenic factors. ANG-II = angiotensin II; ASP = acylation-stimulating protein; CRP = C-reactive protein; FGF = fibroblast growth factor; IGF = insulin-like growth factor; IGFBP = insulin-like growth factor binding protein; IL-6 = interleukin 6; PAI = plasminogen activator inhibitor; TGF = transforming growth factor; TNF = tumor necrosis factor.



IR – Dietary Treatment

- ✓ **Balanced ration – a must & optimum vitamins and minerals**
 - A cup supplement (Equilizer/Optimal)
 - B-vitamins (Horse Plus)
- ✓ **Added Fat – essential fatty acids ??**
 - 2 cups of ground/boiled flax per day ??
- ✓ **Low glycemic hay ???**
 - < 10% NSC
 - low Fructans (sugar) – hay & pasture
 - wet hay to remove sugars ??





IR – Dietary Treatment

✓ Chromium ??

- 5 mg / day
- no research
- not registered for horse – suggested not recommended

✓ Magnesium (magnesium oxide)

- 10-15 g/day

✓ Kelp meal

- 15 -30 grams/day
- Does not improve insulin resistance directly
- Seem to helps in weight loss





Fructans





Fructans

- ✓ Starch/Sugar ???
 - Fructose
 - Fructo-oligosaccharides
- ✓ Plant Storage Carbohydrates
- ✓ Involved in the aetiology (research) of equine laminitis
 - A dose of 7.5 g/kg (of body weight) results in laminitis 48 hours later; (this is) one-half the amount of starch (such as found in sweet feed) required to induce laminitis.”
- ✓ Some Not digested (no enzyme) in the small intestine & in large intestine quick fermentation disrupts normal micro-flora
- ✓ Some are digested, Fructose is a potent insulin promoter





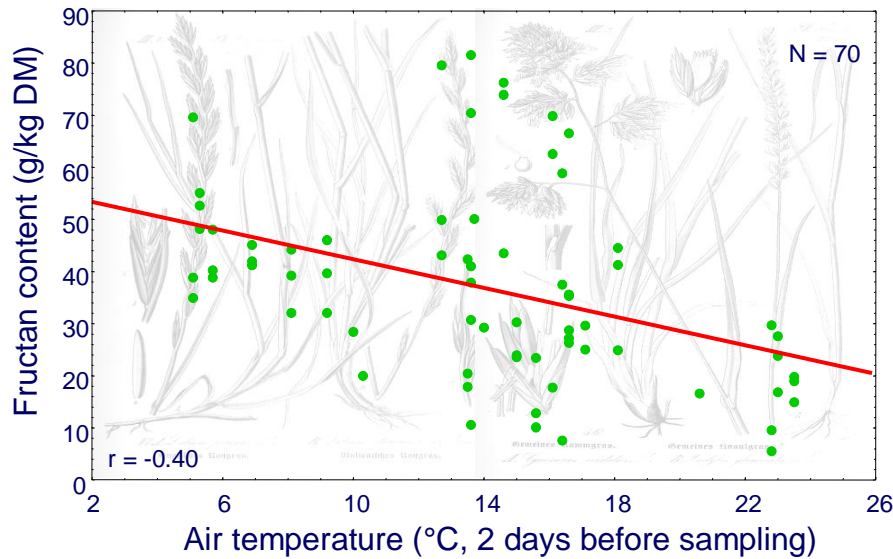
Fructans

- ✓ Horse seek out grass varieties rich in fructan, greedily consuming the sweet stems, sometimes unwittingly to their own detriment.
- ✓ In Australia, where an estimated 50% of laminitis cases are attributed to grass



Predictability of fructan content in grass?

Ambient data



Influencing factor Impact fructans

- Air temperature ↓: ↑
- Ground temperature ↓: ↑

Range r: -0.39 to -0.45

- Sunshine duration, humidity, rainfall: ↔

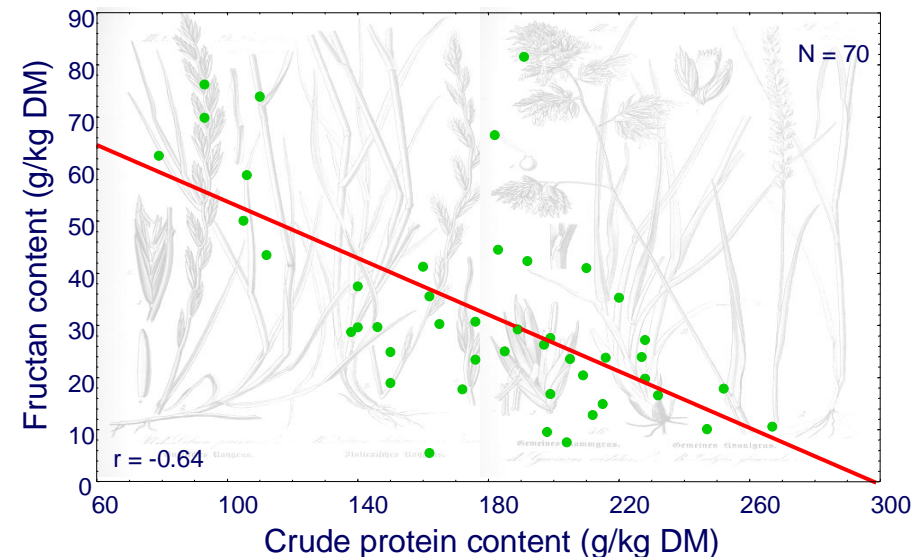
Nutrient content in grass

Influencing factor Impact fructans

- Crude protein ↑: ↓
- Ca, P, Mg, K, Cl ↑: ↓
- Cu, Zn ↑: ↓

Range r: -0.29 to -0.64

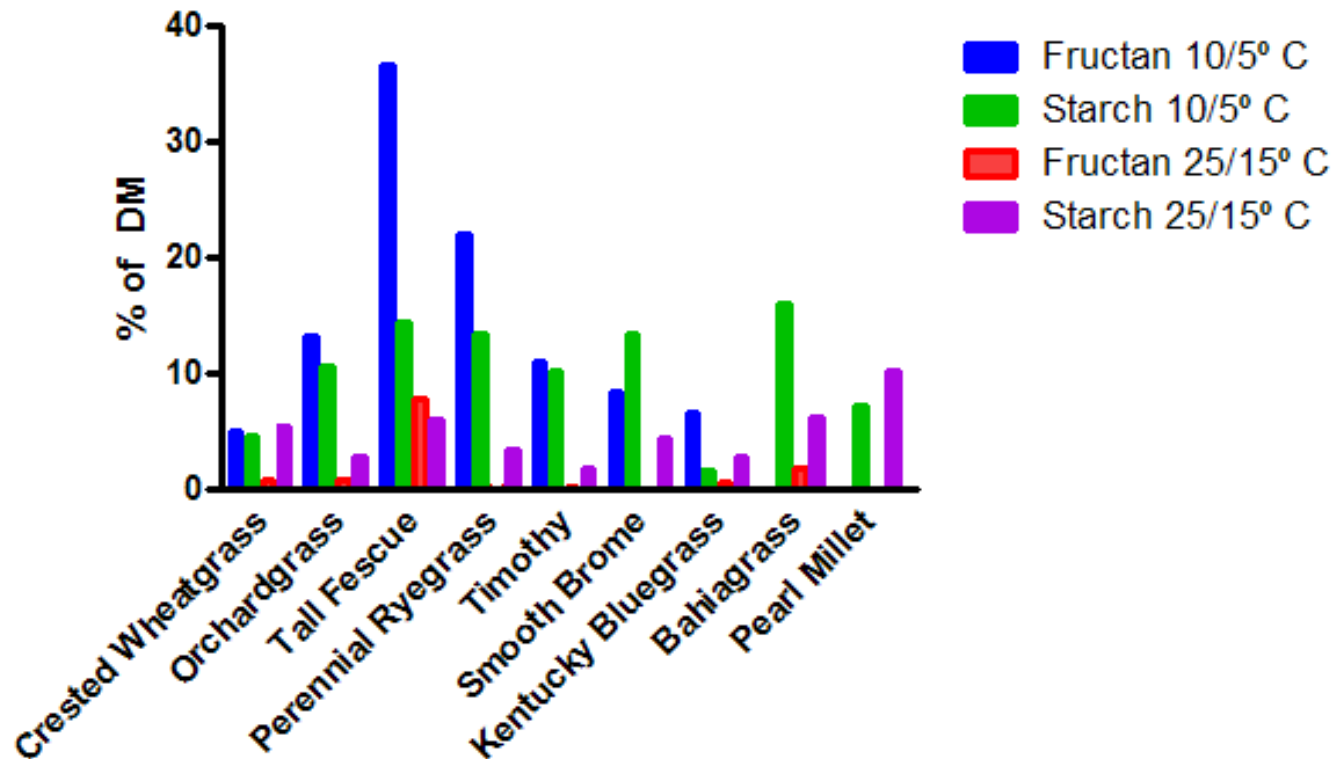
- Crude fiber, NDF, ADF, ADL: ↔



↑: high ↓: low ↔: no correlation

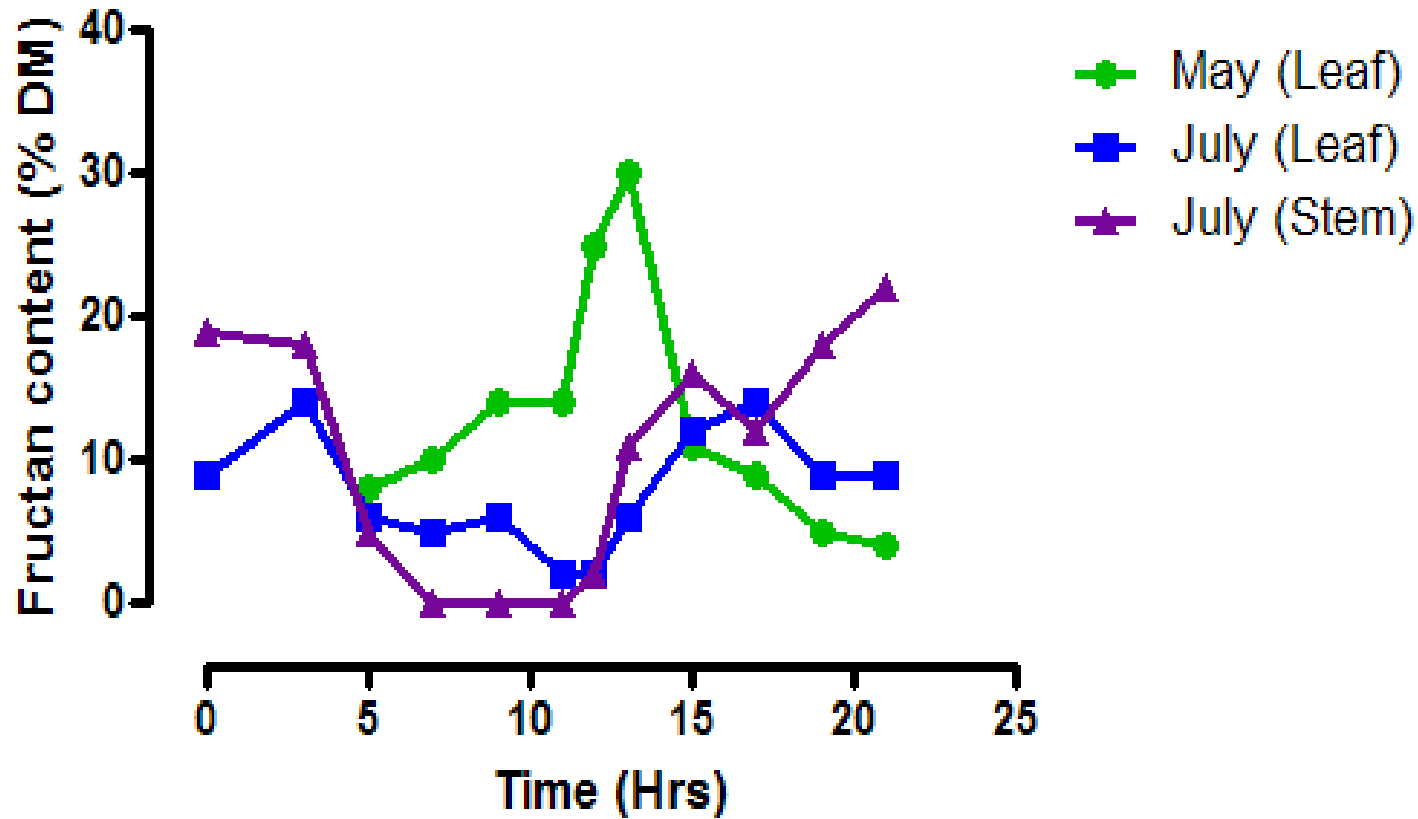


Fructans

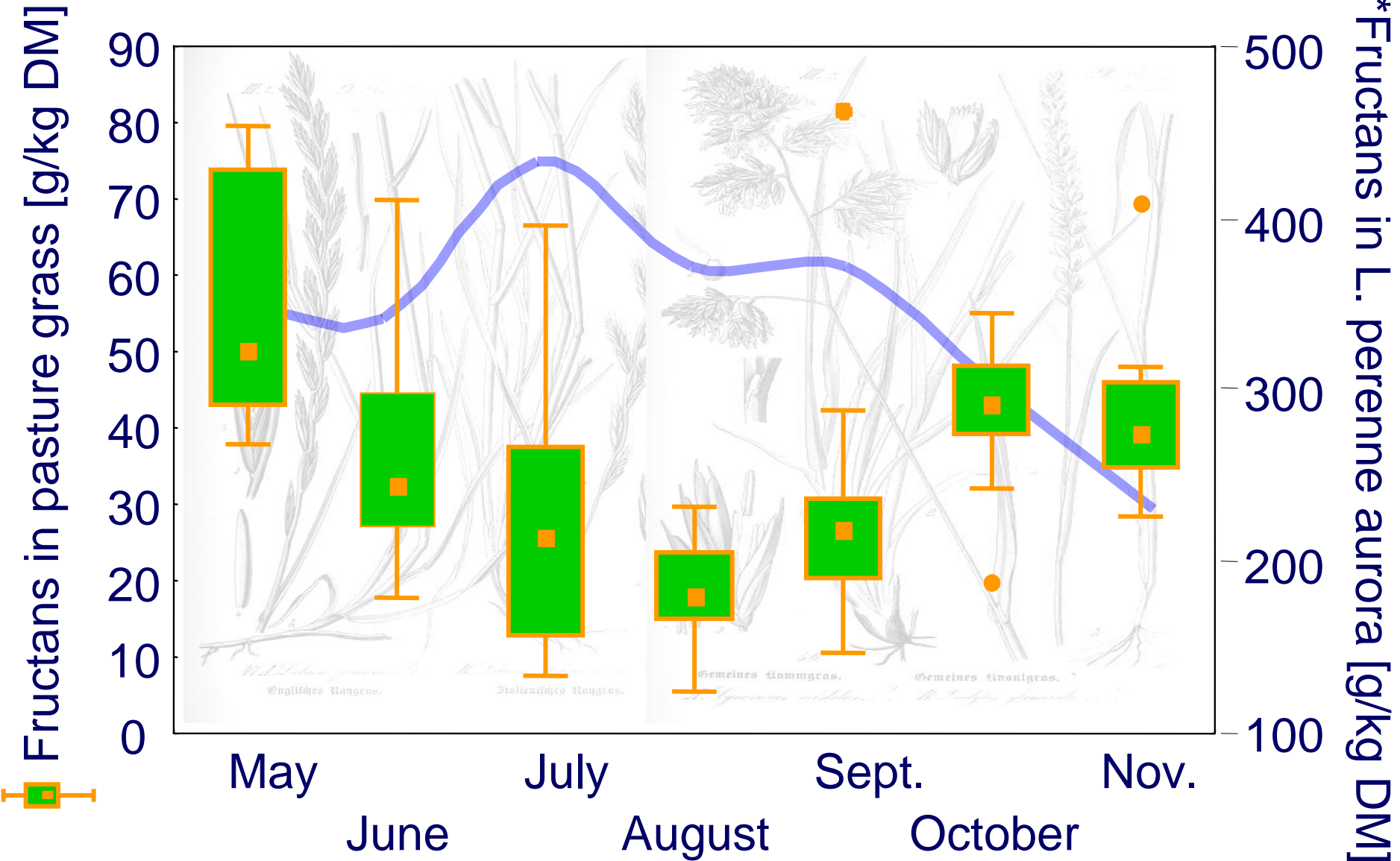




Fructans



Seasonal fructan variation in pasture grass



Time: $P < 0.05$

*Longland et al. (1999)

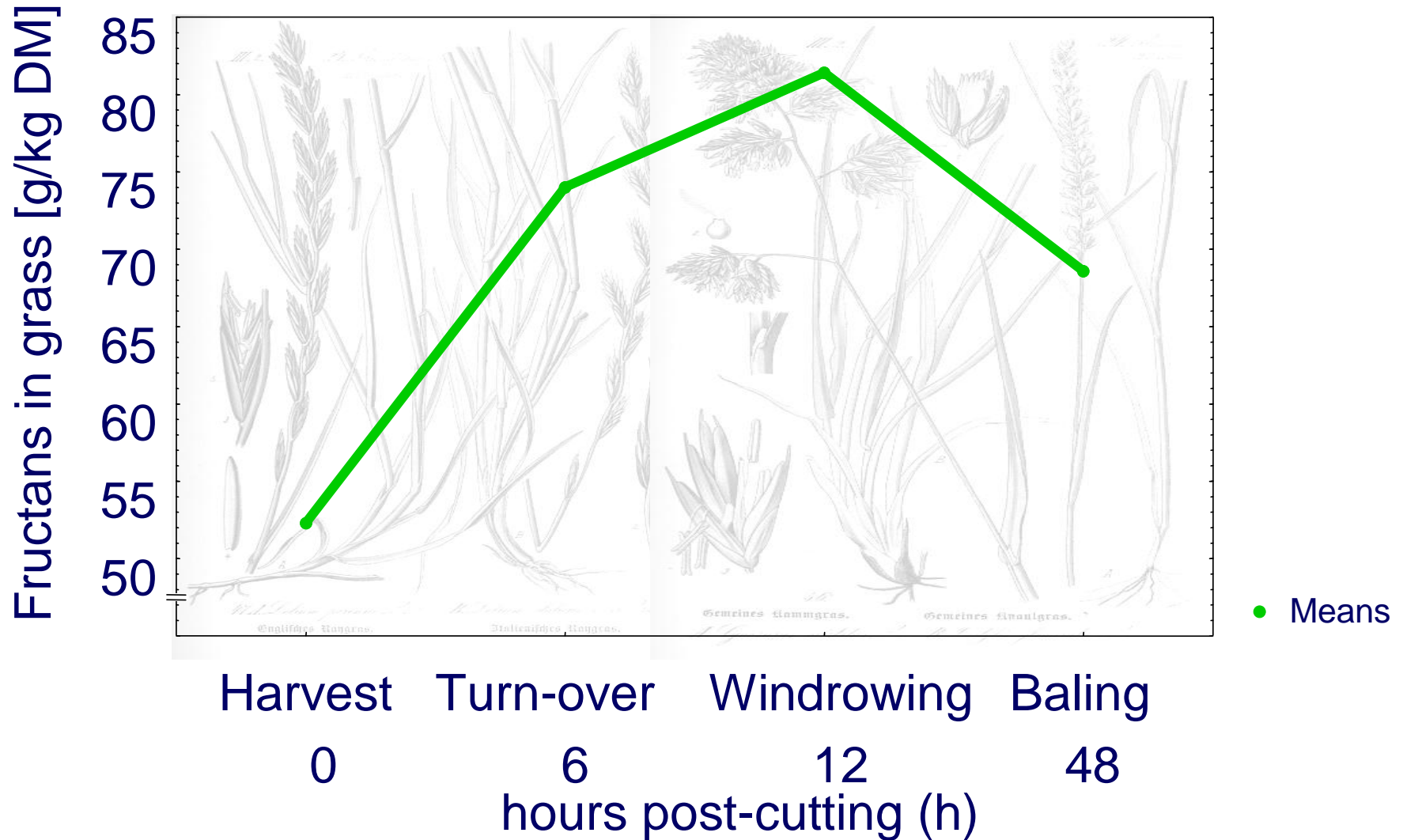


Fructans Accumulation

- ✓ Weeds can also accumulate sugar, starch, or fructan under drought stress
- ✓ Dandelion, thistles and chicory are common weeds often relished by horses even under normal conditions. All three contain inulin, the same form of fructan used to induce laminitis in clinical studies



Fructan development during hay harvesting



N = 3, time: P<0.05



✓ Soak your hay since fructans are water soluble ??

- 60 minutes
- Warm water (30 minutes)
- Multiple soaking

