

# Carbohydrate in Feeds - **Low Starch, Low GI** What does it all mean?

*With increased understanding of the role of carbohydrates in causing Insulin Resistance in horses and the associated risk of conditions such as Laminitis, PSSM and developmental bone diseases, horse owners and trainers are looking for better information on carbohydrate levels in the feeds they use, especially starch and sugar levels.*

**Dr David Wood  
BVSc, MRCVS**

*Feed manufacturers are using terms like **Low Starch**, **Low GI** and **Low NSC** to their products so this is a summary of what the different terms mean, if anything, and what to look for on a feed label.*

**Carbohydrates** provide the main source of energy in horse diets and are found in varying proportions in forages, grains and grain by products. Essentially carbs are built of saccharide (sugar) units, found either singly (monosaccharides) or bonded together in pairs (disaccharides) or in long chains (polysaccharides) like starch. These long chains, in particular cellulose, also form the structural parts of plants.

Carbs like starch and sugars can be broken down by enzymes in the small intestine but the more complex chains like cellulose cannot and are digested by microbes in the hind gut. This difference is critical to the insulin story because small intestine digestion of carbs yields rapidly absorbed sugars which provoke the insulin response in the body. Microbial digestion of the structural “fibre” carbs produces not sugars, but Volatile Fatty Acids, another important energy source for herbivores like horses.

So, we can broadly divide the carbs into the structural fibre types and the non-structural starch and sugars. It's the latter which will provoke the rise in blood insulin levels following a meal. When horses are fed diets high in these **Non-Structural Carbohydrates (NSC)**, it can lead in time to **Insulin Resistance (IR)**.

This NSC also includes the sugars as well as starch. Since sugars dissolve in water we refer to them as **Water Soluble Carbohydrates (WSC)** but that term also includes some more complex carbs like **Fructan** found in forages. Fructan is a short chain of Fructose molecules joined together and can reach high levels in forage feeds under certain conditions. Like starch it is an energy storage compound for plants and like starch it can cause trouble in **IR** horses.

We can approximate the NSC by adding the % **Starch** to the % **WSC** value, as below.

FEED	STARCH %	WSC %	NSC %
SUGAR BEET PULP - Dehydrated	1.1%	10.7%	11.8%
LUCERNE MEAL 17% PROTEIN	1.5%	8.4%	9.7%

**So far as Insulin Resistance goes, it is this NSC value which is the most important.**

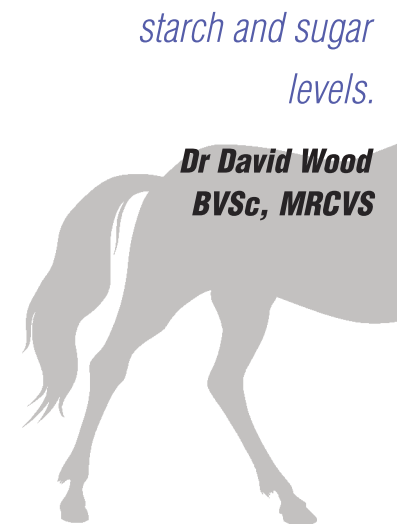
For example, some feeds may contain quite low starch levels, say 10% but high WSC of 15%. These could be classed as “Low Starch” but as the NSC would be 25%, they might be less than ideal for **IR** horses. **C**

When Horsepower was developing low NSC feeds, the search for raw materials led us to investigate a wide range of possible options. One such example was almond hulls, which on first look seemed promising with a starch content of only 3%. However, further testing revealed a WSC level of a whopping 28% so they were rejected and didn't even progress to the all-important “palatability” testing stage.

## **Feed Labelling.**

As yet there is no industry standard or regulation which determines what constitutes “Low” levels of the various carbohydrates in horse feed.

Because the term “NSC” is unfamiliar to most horse owners, bag labels generally refer to the contents being either “Low Starch” or “Low GI”.



Traditional complete feeds tend to have starch content broadly speaking in the range 20% to 40% and NSC levels 5% to 10% higher than this. Supplement feeds are generally somewhat lower. When looking for alternatives for IR horses it would seem reasonable therefore to seek out feeds with starch levels around half those, or less than 15% starch under 20% NSC

### **Low G.I. Feeds**

This GI term refers to the “Glycaemic Index”, a measure of the capacity of various human foods to raise blood glucose levels in people when compared to a standardized dose of pure glucose. This work has not really been done in the same way for horses and the term is unsuitable for use on horse feed labelling. Nevertheless, it persists because of being generally understood thanks to use in the media.

Rather than relying on the “Low GI” handle it would be wise to look for the starch, sugars or NSC content on the bag label. If none of those are listed, then draw your own conclusions. We have tested one “Low GI” feed with a starch content of 27%

### **“Low Starch Feeds”**

Most will list the actual starch content but not always the sugars, WSC or the more significant NSC. Some however, with starch levels below 12% should be perfectly suitable for IR horses. If a value for “Sugars” is provided the NSC can be estimated as above.

**Energy.** Since starch is a primary energy source in normal feeds, low starch complete feeds need to substitute other energy sources. These are fat and fibre. Fat is in the form of vegetable oil and the fibre comes from a variety of raw materials such as the hulls of soya beans and lupin seed, sugar beet pulp, cottonseed, sunflower and Lucerne. Look for these ingredients when selecting this type of feed. Feeds containing grain – wheat, oats, corn or barley will tend to have higher starch and NSC levels. By products like mill mix and rice bran fall somewhere in between.

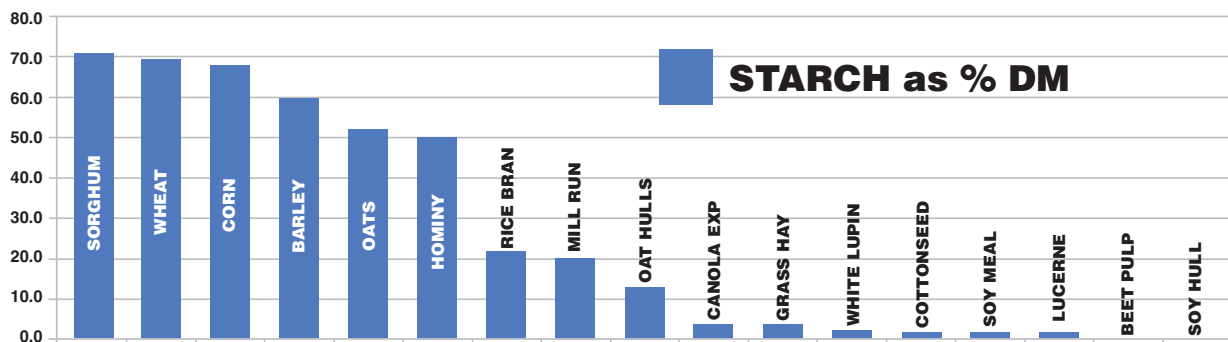
**Forage feeds** all have low starch content but the WSC levels are variable. So far as hays go, Lucerne is probably the best choice in this regard with a starch level typically around 1.5% and WSC averaging around 8.5% giving us about 10% as the NSC value. The WSC content can vary and be significantly higher, but there is no way to tell without a lab test.

For sensitive horses, Lucerne or any other hay can be soaked to partly remove the soluble sugars. Trials in the UK have shown that the best technique is a 30-minute soaking in lukewarm water. Soaking will inevitably remove some other nutrients, mainly soluble minerals and trace elements so these may require additional supplementing.

Finally, when choosing low starch / low NSC feeds remember that it is the overall ration which matters. Generally, the higher the proportion of fibrous feeds or forage in the diet, the lower the starch and sugar content will be.

Since all the components are natural products the precise starch, WSC and NSC content can only be estimated and may vary slightly from what’s estimated on the bag. In that sense, the carbohydrate contents can be somewhat unpredictable, rather like the horses consuming them.

### **Starch Content of common raw materials used in horse feeds.**



**Horsepower** has spent four years developing, refining and testing low starch, low NSC products with the goal of achieving complete balanced feeds rich in high quality protein and with an NSC content of less than 20% for the stud market. These feeds are both extruded to ensure maximum digestibility and minimize the negative effects of starch or sugars entering the hind gut. All the important information about the carbs in these feeds is provided on the bag label.

	PROTEIN	FAT	FIBRE	STARCH	NSC
LOW STARCH BROODMARE	20%	9.2%	8.8%	14%	18%
LOW STARCH GROWER	24%	6.3%	8.7%	12%	18%



**HORSEPOWER**

Toll free **1800681117**

[www.horsepower.com.au](http://www.horsepower.com.au)

