

## **Usage of Cottonseed Meal in feed formulation**

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### **Introduction**

As per Rabobank Global Animal Protein Outlook 2018 report released on 30 November 2017, Animal protein production is expanding around the world, and increasing competition —between the species for share of consumer wallet and between exporters for access to import destinations - is creating many areas of opportunity for both producers and processors. Uncertainty in 2018 will come from the heavy overlay of politics in trade policy—such as the NAFTA negotiation, Brexit and the US – China trade relationship—which is not new but does seem to have become more common, and from biosecurity issues—such as Avian Influenza, African Swine Fever and EHP (a fungal infection in shrimp) - which again appear susceptible to political involvement. Consolidation, evolving retail landscape, alternative proteins, innovation - will dominate the headlines for animal protein in 2018. In food retail, the evolving landscape is one of more channels, more product options, and more velocity for instance due to blurring retail channels. This will bring new areas of opportunity, such as online fresh food sales in China, and generally bring opportunities to strong and agile animal protein supply chains. Alternative proteins will grow further from their small base and continue to capture consumer interest in innovative food. At the same time, the animal protein production chain, and especially aquaculture, will focus on alternative proteins as an innovative feed ingredient. When it comes to innovation, technology—and in particular data-driven technology - is starting to deliver value along the animal supply chain for instance by increased supply chain (cost) management. Two important drivers behind the increase of technology are reducing the environmental footprint and addressing social concerns.

### **Animal Feed Production in India**

Feed business is not rocket science, it's much complicated than that! Oilmeals are integral part of animal feeds. How much of oilmeals are used in animal feeds? This is inexact science. This figure is arrived by doing calculations, as it is impossible to measure actual use. It is expected that by 2025-26, compound cattle feed production will be around 15-20 million tons (Vs. 8.3 MMT in 2017) depending on several factors. In 2025-26, it is estimated that requirement of broiler feeds will be 26 million tonnes (Vs. 12 MMT today) and 13 million tonnes of layer feeds (Vs. 9 MMT today). It is estimated that 710,000 tons of pellet feed is produced and marketed for the culture of freshwater fish. It is estimated that by 2025-26, at least 5-6 million tons of pelleted

fish feed will be sold in India. The Shrimp Feed Industry (5 lakh tonnes per year) is a technologically mature industry in India and produces world class standard feeds through some of the leading aqua feed manufacturers. It is expected that by 2025-26, shrimp feed production will be around 8-10 lakh tons.

### **Use of cottonseed meal in Cattle feeds**

As per study conducted by scientists of National Dairy Research Institute, Karnal (2008), it was found that feeding of Bt cottonseed as a source of protein and energy in the ration of crossbred cows is safe and as nutritious as Non-Bt cottonseed. Cottonseed is a traditional protein and energy supplement in the ration of lactating cows and buffaloes. Cotton is prone to the lepidopteran insect pests, which causes extensive damage to the crop and results not only the financial losses to the farmers but reduces the much needed cottonseed for the feeding of dairy animals and oil extraction for human consumption. In order to provide resistance to the insect's damage, genetically modified (GM) cotton has been developed. GM cotton, having an insect tolerant trait with gene coding for Cry 1 Ac protein derived from *Bacillus thuringiensis* var. Kurstaki, has been introduced in India for large scale production after evaluation of its safety aspects including that of feeding to the dairy cows (Singhal *et al.*, 2001), who reported the absence of Bt protein in the milk as well in blood plasma of cows fed on Bt cottonseed and the milk production as well as feed intake were similar to those fed on non Bt cottonseed based diet. Similar observations were recorded by Singh *et al.* (2002) in lactating buffaloes following the feeding of Bt cottonseed based ration in buffaloes.

Cottonseed meal is a good protein source for ruminants (Göhl, 1982). It is palatable with a nutritive value (for dehulled meals) slightly lower (85-90%) than that of soybean meal. It is among the least expensive sources of protein in some regions (NDDDB, 2012; McGregor, 2000). It is for example the main source of protein for livestock in the cotton growing belt of India (NDDDB, 2012). However, while gossypol is much less toxic to ruminants than to pigs and poultry, it is still recommended to limit its use to mature and non-reproductive animals, females and males, for short periods only and at relatively low inclusion rates, unless free gossypol content is known to be below the risk level. Generally, cottonseed meal can be safely included up to 15% in cattle diets (NDDDB, 2012).

Cottonseed meal is a good protein supplement for poor quality forages and fibrous by-products because of its high protein digestibility. Association with a source of degradable energy increases the efficiency of cottonseed meal supplementation (Brown *et al.*, 1997; Bonsi *et al.*, 1997) since it decreases the urinary nitrogen. Indeed, most of the cottonseed meal energy comes from its fat content (for cottonseed meals with a high amount of residual oil) that, at high levels, does not contribute to the development of the rumen microbial population (Bonsi *et al.*, 1997). Both decorticated and undecorticated cottonseed meal have a constipating effect on cattle, which is beneficial in feeds with a high molasses content (Göhl, 1982).

### **Use of cottonseed meal in broiler feeds**

Cottonseed meal can be used efficiently for broilers if enough digestible lysine is provided in the diet. The level at which cottonseed meal lowers animal performance depends on the level of free gossypol, on the type of cottonseed meal and on the nutritional balance of the diet (Nagalakshmi et al., 2007). A simple weight-for-weight replacement of soybean meal by cottonseed meal is likely to result in amino acid deficiency. Generally, cottonseed meal can be considered to be safe up to 10-15% of the diet (El-Boushy et al., 1989; Fernandez et al., 1995). However some publications report that performance decreased at lower inclusion rates while others found that performance was maintained above the 20% inclusion rate (Azman et al., 2005; Gamboa et al., 2001; Ojewola et al., 2006). At moderate incorporation levels, feed intake can be increased, which impairs feed efficiency (Watkins et al., 1993; Batonon et al., 2015). At higher inclusion rates or when free gossypol content of cottonseed meal is high, the inclusion of iron (as sulfate) or lysine supplementation can help to alleviate the negative effects of cottonseed meal (Henry et al., 2001; Ryan et al., 1986).

Cottonseed meal resulting from glandless cotton varieties does not cause gossypol toxicity and its potential is therefore higher (Diaw et al., 2011). However amino acid digestibility is still lower than that of soybean meal, and care should still be taken when formulating the diet. The general recommendation is to use dehulled cottonseed meal at rates up to 15% of the diet, with careful attention paid to lysine amounts in the feed formulation. Higher rates can be used when cottonseed meal has an economic advantage, even with a risk of lower feed efficiency. In such cases both iron and lysine supplementations are recommended.

### **Use of cottonseed meal in layer feeds**

The main potential problem of using cottonseed meal for layers is the effect of gossypol on egg yolk colour (greenish discoloration, mottling), which occurs mainly after a period of storage (Ryan et al., 1986). Cyclopropenoic acids can also cause a pinkish coloration of the albumen (Nagalakshmi et al., 2007). The problem can be partly solved with iron supplementation, which reduces the effects of gossypol (Panigrahi et al., 1989; Panigrahi, 1992). The effects of cottonseed meal on laying performance depend on the experimental conditions, and particularly on the free gossypol content of the cottonseed meal (Nagalakshmi et al., 2007). Some publications report a decrease in egg laying at inclusion rates as low as 2.5% cottonseed meal in the diet, while other authors report that egg production is good with up to 20% cottonseed meal in the diet (Adeyemo et al., 2008). Cottonseed meal was tested successfully at 25% inclusion rate in broiler breeder diets, with no detrimental effect on performance and on the quality, fertility and hatchability of eggs (Lordelo et al., 2004; Ryan et al., 1986). The general recommendation is to limit cottonseed meal to 10% in layer diets, and to add iron when more than 5% cottonseed meal is included in the diet. Higher levels (15%) can be used when egg yolk coloration problems

do not have marketing consequences. Cottonseed meal from glandless varieties can be used at 15-20% if feed formulation is adequate.

### **Use of cottonseed meal in aqua feeds**

Cottonseed meal is a potential source of protein for fish. As a highly palatable ingredient, it has often been assessed in order to replace soybean meal in fish diets (Li et al., 2006). In addition to the presence of gossypol, the fibre content and the low availability of lysine, methionine and cystine in cottonseed meal limit its use in fish farming. Using decorticated cottonseed meal is preferable (Hertrampf et al., 2000). Cottonseed meal is less digestible than soybean meal in many fish species. Its digestibility is similar to that of soybean meal in red drum and palmetto bass. In the common carp (*Cyprinus carpio*), cottonseed meal compared favourably with groundnut meal, sunflower meal and maize meal and resulted in higher weight gains, and higher feed and protein efficiency (Desai et al., 2011). Because cottonseed meal tends to reduce feed intake, growth and feed efficiency in fish, the recommended levels are generally low, in the 5-15% range, notably in salmonids (Hertrampf et al., 2000). However, the actual limit depends on the fish species, on the type of cottonseed meal and on the level of gossypol. Cottonseed meal can be a protein source for crustaceans, through gossypol and fibre content limit the inclusion rate. It is less digestible than soybean meal for white shrimp. Practical inclusion rates are 5-10% (Hertrampf et al., 2000) though higher levels may be used.

### **Conclusion**

Indian poultry, dairy and aqua industry will continue to grow for next decade mainly due to increase in domestic demand for milk, egg, meat and aqua products. Therefore, future of compound feed industry is bright. Compound feed industry will produce around 54 million tons of all types of feeds, excluding 10.4 million tons of layer feeds prepared at farm level. The oil meal requirements for producing this feed will be around 15 million tons. There will be also requirement of oilmeals for direct feeding of dairy animals (30 million tons).