Hemp was removed from the list of controlled substances in the 2018 Farm Bill, making regulated hemp production legal in the United States. Kentucky agriculturalists and entrepreneurs are at the cutting edge of the United States hemp production and processing industries. Hemp production generally falls into one of three categories: grain, fiber, or floral (CBD extraction). Each production category also produces byproducts; one such byproduct is meal. In order to make hemp oil and fiber processing viable, markets for the remaining meal must be found. The high fiber, fat, and protein of hemp meal make it a potential feedstuff for animal agriculture and a potential substitute for soybean meal in many livestock diets. Despite the potential feedstuff value of hemp, nutrition is not the only factor in determining the future of hemp meal in livestock feed. Agriculturalists and consumers are socially biased on the topic of hemp production, which may prevent full utilization of the crop. Additionally, hemp products face regulatory challenges before they can be incorporated into livestock feedstuffs legally. The purpose of this literature review is to describe current research on the nutritional viability, producer acceptance, and legality of hemp products and byproducts as livestock feedstuffs.

### Perspective One

Though research on hemp seed as a cattle feedstuff is limited, the results seem to be in favor of the product's potential. There are four general types of hemp feed forms, including hemp meal or cake, hemp seed, hemp seed oil, and whole hemp plant (Cutler, K., Handelman, Z., & Wu, S., 2019, 4). The extraction of oil from hemp seeds is similar to other oil producing plants in that the remaining meal is high in protein (Mufasta et al., 1999, 91). Hemp seed protein also has an amino acid profile that resists degradation in the rumen (Gibb, D. J., Shah, M. A., Mir, P. S., & McAllister, T. A., 2005, 224). Low levels of fiber sources, such as whole hemp seed, introduced into ruminate diets helps to stimulate rumination and salivation, which maintains rumen health (Gibb et al., 2005, 223).

In the Canadian study by Mufasta et al., two non-lactating Holstein dairy cows were fed a 50:50 barley silage diet (1999, 92). Seven grams of borage meal, canola meal, heated canola meal, and hemp meal were weighed and placed into nylon bags (Mufasta et al., 1999, 92). The bags were placed into a polyester mesh bag and then incubated in the rumen of each cow for time lengths of “4, 8, 12, 18, 24, 48, 72, and 96 h” (Mufasta et al., 1999, 92). The chemical analysis of the meal mixtures after time in the rumen showed that hemp meal had higher neutral detergent fiber, acid detergent fiber, and acid detergent lignin than other protein sources (Mufasta et al., 1999, 93). The total available crude protein was similar in all four sources tested (Mufasta et al., 1999, 95). Hemp meal was determined to be “a good source of rumen escape protein, equivalent to heat-treated canola meal” (Mufasta et al., 1999, 95). Hemp meal was determined to be similar in all four sources tested (Mufasta et al., 1999, 95). Hemp meal was determined to be “a good source of rumen escape protein, equivalent to heat-treated canola meal” (Mufasta et al., 1999, 95). Hemp meal was determined to be “a good source of rumen escape protein, equivalent to heat-treated canola meal” (Mufasta et al., 1999, 95). Hemp meal was determined to be “a good source of rumen escape protein, equivalent to heat-treated canola meal” (Mufasta et al., 1999, 95).

The 2005 study conducted by Gibb et al. studied the effects of feeding straight hemp seed to feedlot cattle. The study found that hemp seed increased the 18C fatty acids in cattle, including C18:0, C18:1, and C18:2 (Gibb et al., 2005, 228). Hemp seed supplementation also increased levels of n-3 fatty acids, specifically C18:3, in the livestock tissue (Gibb et al., 2005, 228). It is also important to note that this study found increased levels of the conjugated linoleic acid isomer cis-9-trans-11 in the cattle fed hemp seed (Gibb et al., 2005, 228). The cis-9-trans-11 isomer is believed to provide humans with a defense against cancer (Gibb et al., 2005, 228). Gibb et al. found that hemp seed positively alters carcass fat without losing feedlot performance and recommended that full-fat hemp be used as a source of protein in cattle (2005, 228).

### Conclusion

The European Food Safety Authority found that whole hemp plants would be a suitable feed for beef and dairy cattle (2011, 16). The panel also found that hemp seed feed fed to dairy cattle produced milk that was safe for human consumption (European Food Safety Authority, 2011, 16). The panel also found that hemp seed feed fed to dairy cattle produced milk that was safe for human consumption (European Food Safety Authority, 2011, 16). The panel also found that hemp seed feed fed to dairy cattle produced milk that was safe for human consumption (European Food Safety Authority, 2011, 16). The panel also found that hemp seed feed fed to dairy cattle produced milk that was safe for human consumption (European Food Safety Authority, 2011, 16). The panel also found that hemp seed feed fed to dairy cattle produced milk that was safe for human consumption (European Food Safety Authority, 2011, 16). The panel also found that hemp seed feed fed to dairy cattle produced milk that was safe for human consumption (European Food Safety Authority, 2011, 16).

While profits and revenues are the major factors for most farmers (Henderson, 2019), other agriculturalists are hesitant when it comes to the social and political aspects of hemp production. Brooks from Farm Journal wrote: Well, because of my experiences growing up, I've struggled with the idea of cannabis production of any kind. I know many of you have, too, because I've read your emails and listened to you on the phone. We know from Farm Journal surveys 66% of farmers believe there's a stigma to growing cannabis, yet 48% of farmers are interested in growing it. (2019) The United States Secretary of Agriculture Sonny Perdue also seems hesitant on the subject of hemp production, especially as an animal feed. He has been quoted as saying:

Hemp in animal feed? I'm not aware of any uses of hemp in animal feed. I know there are other uses... But we're trying to determine really what those individual uses are. Feed, it possibly could be involved in there. That has not been one of the primary uses we've heard of. We hear a lot of industrial uses for it, but I think it remains to be seen if part of the product could be used in animal agriculture. (Stewart 2019)

### Author’s Perspective and Conclusion

There are true concerns about the long-term effects of hemp production, from the use of oil in humans to the use of meal in feedstuffs. However, agriculturalists are working towards spending more time and resources on hemp research to mitigate these concerns. The current research points to the conclusion that hemp meal would be a valuable asset to the cattle industry. As a feed, it has the potential to increase rumination, support ruminal health, and increase protein in livestock diets. If hemp meal continues to prove to be of a nutritional value to livestock, the only barrier to widespread use will be that of public opinion. The court of public opinion is the largest obstacle the industry faces. However, current social trends towards “natural” products and medicines like hemp oil could ease the way for hemp legalization. If agriculturalists capitalize on this opportunity, it is possible that hemp meal could become as commonplace as soybean meal in livestock feed. Hemp production offers American agriculturalists a new and exciting avenue for further research into a potential livestock feedstuff. Agriculturalists must advocate with farmers, consumers, and legislators to increase awareness on the potential benefits of the product and reduce the stigma on hemp production.