

Fertilizer Deep Placement in Nepal

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Part One – Fertilizer Deep Placement (FDP) Information - Canada

FDP Description

Fertilizer Deep Placement is a practice that has been implemented in various third world countries with great success. These countries and the benefits of FDP will be discussed later, however the steps to completing the FDP process can be split into two steps (*Fertilizer Deep Placement*, 2015). The first step requires a fertilizer briquette making machine as the one shown in figure 1.

This machine will be supplied by Canadian companies to Nepal. briquette making machines feed commercially available fertilizers through the top, compact the fertilizer and then cut the compacted fertilizer into small granules, larger than typical fertilizer granules,



Figure 1

which can be used in the next process of FDP. Once an adequate amount is produced, the granules are evenly distributed throughout the field. This process can be done manually, or simple placement machines can be used to reduce manual labour. What's important to note about the placement of these briquettes is that they are placed about 7-10 centimeters below the surface in an organized fashion. This practice can be used in a variety of different crops, however the highest improvement in yields have been noted from the use of urea fertilizer with rice. This is because urea fertilizer contains 46% nitrogen, which is a large ratio compared to other typical nitrogen-phosphorus-potassium (or NPK) blends of fertilizer (*Fertilizer Deep Placement*, 2015). Although, as stated earlier, the FDP system can be used with other crops, the main focus of this paper will be to implement FDP with rice fields, given that they yield the most improvements and the highest success rate compared to other crops. This doesn't mean this technique cannot be

later pushed towards other crops, it is just an intellectual decision to focus on the industry that will gain the greatest improvement before pushing to other areas.

Product Manufacturing Locations in Canada

Briquette making machine factories where these machines are made have been located in different areas in Canada. Originally, the company of “BioTra Solutions” located in Quebec had been predicted to be the manufacturer of choice. However, after further investigation a factory had been located in Vancouver, BC, called “Briquetting Systems” which is a much more ideal location for the process of manufacturing and shipping briquetting machines to Nepal. This is due to the fact that shipping from the west coast would be far less expensive than shipping off the east coast in terms of shipping to Nepal. If a market arises for briquettes, then competition in close countries such as China and India will have to be taken into account and will be discussed later in the article.

Machinery Required and Cost

While locating costs from Canadian companies has been a struggle, other prices for sales of briquetting machines have been estimated to be approximately \$2,200 US per unit producing 250kg of briquettes per hour (Ladha, et al. 2000). While this may seem high, other factors must be taken into account. These factors include that these larger units can support multiple farmers, so the target business for these larger machines would be corporations, larger farms or even entrepreneurs setting out to rent out this equipment or use it to directly sell briquettes to local farmers. Smaller briquette machines are possible to be manufactured while at lower costs, one in particular being produced in collaboration with the International Fertilizer Development Center, Metal Industries Development Center and Soil Research modified a machine which cost was

reduced to US \$1,200 (Avila, Jorge. 2012). This is a much more affordable price for smaller scale farms considering the studies that have been put in place. These studies include experiments in Bangladesh done on farms between 0.01ha-0.52ha. In this study, the average net income of the farmers increased by 21.75% (Avila, Jorge. 2012). It is to no surprise that 550,000 farmers are currently using FDP technology, even though 1800 machines were manufactured to support the Bangladesh farmers (Islam et al. 2011).

Labour Required

When it comes to labour, there is little to no man power needed to operate the briquette machines.

Smaller briquette machines only require the fertilizer to be loaded into the top, while others also require a human manually cutting the hard compacted fertilizer into briquettes as they pass out of the machine.



However the placement of the briquettes requires labour and must be done with one to seven days after the transplanted (*Fertilizer Deep Placement*, 2015). This process can be made easier with simple machines to dig the holes, or even elaborate ones that plant the holes and place the briquette, however for cost reasons manually doing this process is still very possible.

Inputs Required

The main input to this process is fertilizer, more specifically urea for rice farmers. Urea the world's most widely used for of nitrogen fertilizer, containing 46% Nitrogen. This may pose a problem for some Nepalese farmers who cannot afford fertilizer in the first place regardless if the

investment in the FDP process averages an increase in \$400/hectare of profit annually (*Fertilizer Deep Placement*, 2015). A small but notable input is also oil which is used to lube the machine when needed (*Fertilizer Briquetter*, n.d). On the bright side the machines don't need to be lubed very frequently. Another form of input that is worth noting is the increased amount of labour used. This labour isn't referring to operating the machines as they require little to no manpower, but to the input needed to place the briquettes in the fields. This may impose an increased price to the farmer considering how much land they own and whether they can complete the process in the one to seven day time interval that is recommended with this process.

Market Opportunity

If FDP technology takes off in Nepal, a market demand for briquetting machines will increase. However, considering the inputs of FDP, or more specifically; Urea Deep Placement (UDP), a demand for urea to be sold in Nepal along with the rising incomes resulting from UDP will be present. In simpler terms; the more people using briquetting machines, the more people will demand urea considering it is the main input for this process. While the market opportunity may not seem large at first for Canadian companies (1800 briquetting machines supported 550,000 rice farmers in Bangladesh (Islam et al, 2011), the ripple effect that the implementation of UDP will create in Nepal will create larger markets due to the increased GDP of the government, and increases income of Nepal farmers.

Part Two – Fertilizer Deep Placement - Nepal

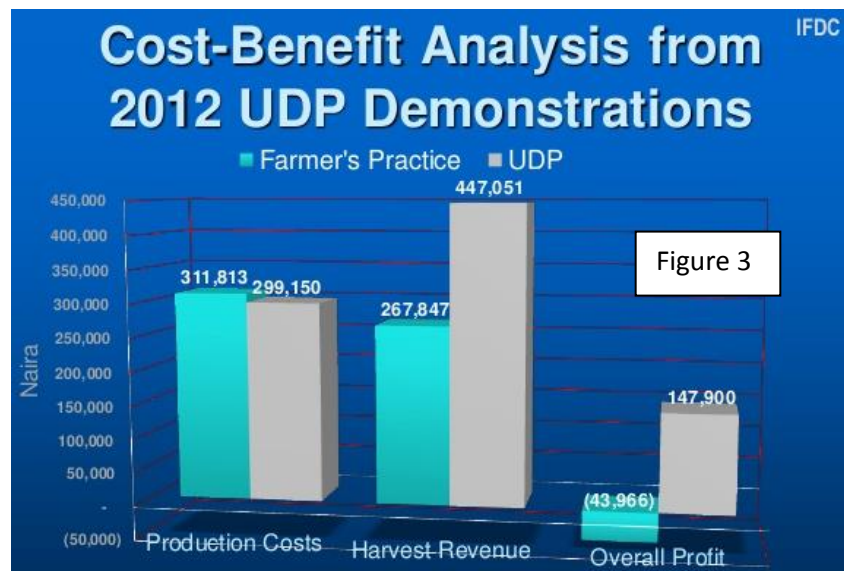
Needs of Nepal

Nepal is currently facing a food crisis, regardless of the fact that over 70 percent of Nepal's population work in the agriculture sector which only accounts for 38% of the gross domestic product (GDP) in Nepal (*Agriculture and Food Security*, 2015). Statistics show that almost 50 percent of Nepal's population is undernourished (*Agriculture and Food Security*, 2015). On top of this, 28% of Nepal's land is already being used for agricultural purposes (Chapagain, T. 2015) Nepal is in desperate need for higher efficiency of agriculture. Rice, being a very popular commodity in poorer countries due to its inexpensive price, could be very beneficial to improve upon in terms of yields as rice is grown in the terai regions of Nepal.

FDP Benefits in Nepal

When FDP techniques are used alongside rice farmers, rice yields have been known to increase between 15%-35%, along with less nitrogen based fertilizer being used; approximately 25%-40% (Pierce-Quinonez, 2013). Figure 3 demonstrates studies done in Nigeria. This practice also

reduced nitrogen loss due to nitrogen run-off, making more available to the plant throughout its entire growth cycle (*Fertilizer Deep Placement*, 2015). When it comes to farmers, a decrease



in production cost is seen, considering less fertilizer is used along with increased yields in plants. It is estimated that in rice paddies, an increase of \$400 per hectare is made annually (*Fertilizer Deep Placement*, 2015). This helps the food security situation in Nepal, especially for subsistence farmers. When it comes to larger fields that are too large for the manual placement of the briquettes for the farmers themselves, labour will be demanded to place the briquettes into the field making labour jobs for non-farmers. However, it has been noticed that the use of FDP lowers weed numbers in farms, which can be a nice trade-off for more work implementing FDP and less work removing weeds from fields. When weeds are not an issue, this can lead to increases in rural employment by bringing jobs into the community the farms are located in. Gross domestic product of Nepal also has the opportunity to increase. This is because the more farmers using the FDP process, the higher yields the farmers will be making which in turn can lead to higher exports and less imports of food products. This is because with more food being produced in Nepal, the less the need will be to import food sources, leading to excess money that can be spent elsewhere. If the FDP process takes off completely, this can lead to exports of goods to other countries of need.

Environmental Benefits to Nepal

Along with an increase in yields and profit to Nepalese farmers comes another large benefit to the use of FDP; its environmental impact. When traditional methods are used, especially in flooded rice paddies using urea, plenty of nitrogen is lost creating an inefficient use of nitrogen in the fertilizer (*Fertilizer Deep Placement*, 2015). This is caused by runoff, being the process of water draining away from the surface of an area of land; in this case through the fields through rainfall. When this occurs the water draining from the system passes through the nitrogen, changing the nitrogen into nitrates. Since nitrates are very mobile, they flow with the water and

have the potential to contaminate water systems, including rivers, ponds and even wells. This can be disastrous in small towns that rely on such water systems, or on the smaller families that rely on wells for drinking water. When FDP processes are used with urea, the majority of the nitrogen stays in the form of ammonium. This is important because ammonium is very immobile compared to the nitrates that runoff creates. Looking from a statistics perspective, only approximately 4% of nitrogen is lost to the environment (*Fertilizer Deep Placement*, 2015), which is amazing compared to the average of 35% amount lost when using normal practices.

Market Strategies to Make FDP Work

While FDP yields benefits that sound great to every rice farmer in Nepal, briquetting machine prices may make Nepal farmers think twice about implementing this technology. However, market strategies are available to ensure that FDP has the ability to make its way into the Nepal economy, just as it did in Bangladesh. The first way in which FDP can be implemented is through small businesses or entrepreneurs. People willing to invest in briquette machines have the opportunity to make a growing market of fertilizer briquette sales. Considering the low cost of operating these briquetting machines, this market could be huge in Nepal for farmers wishing to adopt the FDP technology. Another option is the grouping of small landholders conjoining to make larger cooperations, allowing for larger inputs to be bought; including FDP. This has been already implemented as in the small village of Niena in the Sikasso region of Mali, 512 small producers conjoined to make the “Niena Women’s Cooperative of Rice Producers” (figure 4 is an image of some of the ladies in this cooperation).



Figure 4

Most of the women in this cooperation were known to have less than 2 hectares of land each with

poor food security. Upon making the cooperation the women were able to afford larger inputs, one of which is FDP. When testing the FDP process the cooperation noted less weeds in their fields, cleaner water sources and a 20 percent increase in yield while only using 45 percent of the fertilizer previously used; another example of FDP being implemented into third world countries with little effort and a large effect (*Looking Toward the Future with UDP*, 2015). The cooperation claimed that with their current fertilizer cost being 1,750CFA (US \$2.80) per bag and the higher yields experienced that the adoption of FDP processes was quite the investment.

Competition in the Global Market

Canada currently has an average minimum wage of \$7.82 per hour (in international dollars). With a higher minimum wage comes an increased cost per producing any good that requires man-power. This is the case with producing briquette machines. Canadian companies also face the difficulty of distance, increasing briquette prices even further. However, Nepal is located directly beside China and India. China has an average minimum wage of \$3.44 per hour, and India has an average minimum wage of \$1.02 per hour. This means that China and India both have an absolute advantage over Canada, meaning that their prices will already be less expensive to create briquette making machines. Alongside this, China and India are much better off bringing business to Nepal because of their geographic locations being directly beside Nepal, while Canadian companies must ship the machines over-seas. While Canadian companies can still try and create the market in Nepal for briquetting machines, in the long run it can be easily taken over by India or China strictly because their cost to produce the machines is cheaper, meaning they can place them on the market for a far lower price than Canadian companies can compete with. In fact, a company in India called “Shanta Engineering” has already claimed to have produced a briquetting machine capable of producing urea briquettes; the exact type of

briquette that has a large potential to improve the rice market in Nepal (*Fertilizer Briquetter*).

With India and China having this absolute advantage over Canada, it makes it will make it very difficult for Canada to stay in the market if the use of briquetting machines becomes more relevant in the Nepalese economy.

Challenges in the Canada to Nepal Briquette Market

First off, the biggest challenge this idea faces is the implementing of briquettes to Nepalese farmers. Since Nepal is a poor country, as discussed earlier, implementing the briquette machines directly to farmers requires communication and collaboration amongst group of farmer or even government loans to get the FDP practice into effect. It isn't always easy to conjoin groups of farmers, while government loans can seem very intimidating to small farmers even though the benefits of FDP are so substantial. This makes things more difficult for poor isolated farmers even though it is still very possible for poor subsequent farmers in more densely populated areas due to the conjoining of farmers to buy new inputs such as FDP. When it comes to selling briquette machines to entrepreneurs, some Nepalese families can barely afford to buy fertilizer on its own, much less briquettes that take extra time to place. The idea of entrepreneurs buying these machines to sell briquettes to farmers may only work in areas that are already a bit better off compared to people who are severely struggling with subsequent farming. Briquette machines however can be easily implemented into corporations that are already in place with ease on the other hand. However, once FDP is implemented and on the go in farms it is extremely profitable and easy to continue due to its benefits versus the low increased labour input.

Possible Long Term Effects of FDP

Although FDP may be difficult to implement in Nepal due to the amount of funding, it is not impossible to do with organized efforts. I think that the implementation of FDP to Nepal is extremely realistic, however, I don't think that it is a market that Canada can compete in in the long run. Canada, however, has the potential to start up the market and bring attention to the practice of FDP. If FDP is first implemented into corporations and small businesses it has the capability to increase the amount of rice and other plants on the market, which in turn can decrease the cost of food. In the long run this can continue to stack up with less money spent on food from the citizens leading to citizens investing in smarter and more profitable techniques for farming including FDP. FDP definitely can have an effect on the food security in Nepal, even without poor subsequent farmers utilizing the technology. Once FDP begins to catch on markets from India and China may perceive selling briquette machines being profitable. Since India and China have an absolute advantage over Canada, this means lower priced briquette machines, and more being introduced to Nepal seeing that it is more feasible to introduce to smaller farms. If China and India jumped into the market it could completely eliminate Canada from the market, but can be extremely beneficial to Nepal in terms of overall food scarcity. While FDP has the potential to help drastically decline food scarcity in Nepal, it also could help with controlling water pollution. This is because, as mentioned earlier, that normal practices of placing fertilizer yield about 35% loss of Nitrogen (*Fertilizer Deep Placement*. 2015) which can be cut down drastically to 4% using FDP. This in turn contributes to less nitrogen runoff to nearby ponds and wells that could potentially be contaminated by the nitrogen runoff. While the practice of FDP

may have been intended to increase food security in Nepal, it has the capability to do much more.

In Conclusion

FDP can have extremely large economic impacts on Nepal, however without anyone willing to jump into the market this practice cannot be started. Although China and India have an absolute advantage over Canada in briquette machine manufacturing, it is still profitable for Canada to produce and sell briquettes to corporations, entrepreneurs and groups of farmers. The knowledge of environmental and economic benefits of FDP can begin to spread and create a higher demand for briquette machines allowing India and China to want to become a part of the market; something extremely good for Nepal regardless of kicking Canada out of the Nepal market. However, in the short run, I believe that it is still extremely viable and profitable for Canada to enter the briquette marketing business to Nepal.

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