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Technical efficiency, subsidy and financial performance: A case study of BVFCL, Namrup

Priyanka Bharali, Prof. Deb Kumar Chakraborty

Department of Economics, Dibrugarh University, Dibrugarh, Assam, 786004, India
[1]priyankasm13@gmail.com, [2]dkc@dibru.ac.in

Abstract

Objective: Brahmaputra Valley Fertilizer Corporation Limited (BVFCL)is situated in Namrup, Assam in India. The objective of the study is to analyse the performance of the unit both in terms of production and financial terms. Thus, efficiency of the unit in using its inputs and financial performance is reported here.
Methods: The study is based on secondary data collected from the annual reports of BVFCL from 2003-2013. Output is measured in terms of gross value added and it is deflated by WPI. Capital is calculated using perpetual inventory method and labour is the total number of employees during that period. Time series framework has been used for making the analysis. Cobb Douglas Production Function has been estimated for stochastic production function. In deterministic frontier any shortfall in observed output from maximum output is attributed to technical inefficiency, but in reality it is affected by random factors also; so stochastic production function has been used as it considers all factors.
Findings: In the production function only labour variable is significant, indicating overuse of labour. The technical efficiency of the unit is on a declining trend. Subsidy is positively correlated with amount of production and cost of production. BVFCL is the only fertilizer unit in entire North Eastern Region (NER), the declining efficiency of the unit is due to age old technology used. The financial performance of the unit does not show any better picture since over the time the subsidy burden is rising. The increase in production has been accompanied by increased cost of production and subsidy as the unit fails to use modern methods and technology.
Application: The study reflects that the use advance methods of production will improve efficiency and productivity of the unit, which in turn will help to meet the increase subsidy burden.
Keywords: Time Series, Stochastic Production Function, Technical efficiency and Financial Performance.

1. Introduction

Agriculture plays a vital and significant role in economic development of a developing nation. The obstacle in the path of agricultural development is fragmentation of land, depletion of ground water, improper irrigation facilities, etc. The availability of land is declining due to growing population and use of land for commercial purpose. The major problem which is being faced by our farmers is the declining land productivity with reduced crop yields. The major factors contributing to the reduced land productivity is poor soil quality caused by continuous cropping without using sufficient mineral fertilizers and manures and absence of modern inputs. If the productivity and production of agricultural products are not increased/ sustained, it will be difficult to meet the demand of growing population.Fertilizer along with other inputs plays a vital role in helping farmers to achieve their high level of production. Fertilizers are chemical compounds given to plants to promote growth; they are usually applied either through the soil or through leaves. Balanced fertilization is one of the most important tools to achieve maximum output from land. Balanced fertilization is defined as the rational use of fertilizers and other inputs for best possible supply of all essential nutrients for maximum crop yield. The supply sources of fertilizer in India are domestic production and imports.

The country has become self-reliant in food production over the years as the Government has been pursuing policies to increase the availability and consumption of fertilizers at affordable prices in the country in order to enhance agricultural productivity. India's per hectare consumption of fertilizer has come a long way, it was less than 1/4th of the global average, and has increased tremendously at present.

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The concept of Green Revolution in India was to use High Yielding Variety (HYV) seeds in cultivation and in order to attain better results Green Revolution in 60's was linked to the use of fertilizer, availability of proper irrigation system.It was during these phase of 60's that fertilizer industry got a positive boost as it utilization has increased many times. Although fertilizer sector has grown in size and presently India is the third largest fertilizer producer in the world, but the production of fertilizer is not yet sufficient to meet its growing demand. Both consumption and production of fertilizer is skewed towards one type of fertilizer, i.e., urea due to the subsidy associated with it. Increasing the awareness about using the right quantity of fertilizer is imminent for further development of fertilizer sector. The growth and improvement of agricultural and fertilizer sector will contribute positively to economic development of the nation. In Assam which is primarily an agrarian society the improvement of agricultural productivity and development of fertilizer industry will contribute to state GDP in a positive way. The main objective of the fertilizer industry is to ensure the supply of primary and secondary nutrients in the required quantities to every nook and corner of the nation all throughout the year. The Indian Fertilizer Industry is one of the allied sectors of the agricultural sphere and it has emerged as the third largest producer of nitrogenous fertilizers. The adoption of back to back Five Year plans for improving both agricultural and industrial sector has paved the way for self-sufficiency in the production of food grains.

The challenge before the Indian fertilizer industry is to balance the mis-match between demand and supply of fertilizer. This shortage of fertilizer supply in India has led to the heavy import of fertilizer to meet the growing demand of fertilizer. The fertilizer industry of India was under the protected umbrella of Retention Price Scheme (RPS) of the Indian government for a long time, which has been presently replaced by New Price Scheme (NPS). Under NPS regime the units are divided into six groups based on their age and feedstock. The units within a group are allowed the group average concession price updated up till March 2003, or their own concession price, whichever is lower. The energy efficiency is allowed as per the pre-set energy norms which are based on best achieved energy levels up till March 2003. The cost of fuel / feedstock is completely pass-through under the subsidy regime. There has been sharp increase in cost of production because fuel / feedstock cost have risen sharply with the rising prices of energy basket (Gas, LNG, Fuel Oil, Naphtha etc.) and consequently subsidy level have increased. The burden of fertilizer subsidies continues to mount for the government, hence improving the fertilizer production is essential. The growth and development of agriculture in India is also hugely dependent on the fertilizer industry. Thus the uncertainties in the fertilizer industry could create obstacle in the path of agricultural development. And for attaining the goal of self- reliance, the rate and pattern of industrial development are also equally crucial.

The Namrup Fertilizer Complex was renamed as Brahmputra Valley Fertilizer Corporation Limited (BVFCL) after bifurcation from erstwhile Hindustan Fertilizer Corporation Limited w.e.f. 1st April 2002. BVFCL is engaged in the manufacture of Urea, Bio- fertilizers, Vermi- Compost manure at Namrup (Assam) and also trading of Seeds, Pesticides, and Fertilizers (MOP, DAP/SSP). Corporation is marketing its products under the brand name "Mukta"**.** Of the 3 units of BVFCL Namrup-I has stopped production since mid-2002 due to non-viability of cost of production. BVFCL installed capacity on 1.04. 2010 for Namrup-II and Namrup–III was 110.4 LMT and 144 LMT respectively. In 2010-11 the amount of urea produced by Namrup–II stood at 39.6 L MT which increased to 50.4 LMT. The production for Namrup – III decreased from 91.5 LMT in 2010-11 to 89.0 LMT in 2011-12. The capacity utilization for Namrup– II and Namrup – III stood at 45.7% and 61.4% respectively.In context of state like Assam where agriculture is the primary occupation and is also industrially backward; the proper functioning of the only fertilizer plant can play a double fold role. On one hand agricultural productivity will improve and will also lead to efficient use of scarce resources of the state by the industry. The process of improving the productivity is essential to ensure efficient use of resources and to lead the industry towards growth. Therefore productivity measurement is important to evaluate the performance of the industry. The study of BVFCL will bring out how effectively investment can be made for raising the productivity of the resources used. Better utilization of capacity will lower cost of production; thus help to reduce price and increase its per capita consumption. And for Assam which is marked by capital scarcity, underutilization of capacity is a waste of resources. The improvement in the fertilizer industry will alsodirectly and indirectly generate employment in the states of Assam & other North- Eastern states which are predominantly economically backward by improving the scenario of both agricultural sector and industrial sector.

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In this study we try to analyze the efficiency and elasticity of substitution of factors of production by using stochastic production function for BVFCL, the only fertilizer plant of North Eastern States. And try to examine the relation between financial ratio and subsidy received by the plant. The overview of fertilizer industry reflects, the consumption of fertilizer has increased overtime leading to improvement in productivity of agricultural sector, however the production of fertilizer by domestic units have remained stagnant. The import of fertilizers has increased to meet the increasing demand of fertilizer; creating a burden on our BoP. Due to low/no addition in domestic capacity coupled with rise in demand for fertilizers during the last two decades, imports have increased significantly since the 2000s.

Table 1. Production, imports and consumption of all fertilizers

Year	Production	Imports	Consumption
2002-03	14468	1757	16094
2003-04	14265	2018	16798
2004-05	15405	2752	18398
2005-06	15575	5254	20340
2006-07	16095	6080	21651
2007-08	14706.5	7750.16	22570.00
2008-09	14334	10221	12470
2009-10	16221	9148	26486
2010-11	16380	12364	28122
2011-12	16363	13002	27790
2012-13	15735	9157	25534
2013-14	16092	7434	24482
2014-15	16269	9135	25576

Source: Indian Fertilizer Scenario 2010, 2015

In the last few years, there has been a growing trend of subsidy burden on the Government. Higher subsidy payout is associated to increase in consumption, increased production, higher input cost, increasing import prices of fertilizers as well as feedstock and intermediaries and more importantly trying to keep the retail price of the fertilizers at affordable levels.

Table 2. Subsidy on fertilizers (Rs. in Crores)

Year	Subsidy Released		Total subsidy disbursed
	Urea	P & K	
2002-03	7788	3225	11013
2003-04	8509	3326	11835
2004-05	10637	5142	15779
2005-06	11749	6550	18299
2006-07	15354	10598	25952
2007-08	23204	17134	40338
2008-09	33940	65555	99495
2009-10	24580	39452	64032
2010-11	24336	41500	65836
2011-12	37760	36809	74569
2012-13	40016	30576	70592
2013-14	41853	29427	71280
2014-15	54400.01	20667.30	75067.31

Source: Indian Fertilizer Scenario 2010,2015

Table 1 shows that over the year, both production and import of fertilizers has increased to meet the growing consumption needs of the nation. With the increase in consumption the amount of subsidy released by government is also on a rising trend to encourage both consumption and production of fertilizer (Table 2). In [1,2] tested the hypothesis of constant returns to scale for two industries of Assam – HFCL, Namrup and Oil, Duliajan using the Restricted Least Squares Technique (RLS) and The Unrestricted Least Squares (ULS) Technique for the production process. The study for the data from 1991 to 2000 for HFCL, found RLS to be more suitable.

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HFCL, Namrup was able to increase output at the same proportion of increase in its input. It was found that the HFCL unit of Namrup was running in the declining stage of business cycle and was making loss day by day due to financial problem, political causes. The capital investment and investment in labour in the industry was poor. Though the hypothesis of constant returns to scale was accepted but in real world it was not happening, but the unit is in position to improve its output by increasing investment in labour and capital and proper maintenance. In [2] generalized C-D production for HFCL Namrup fertilizer plant. But due to small value of R^2, the C-D production model was not suitable. Using RLS technique for VES production the elasticity of substitution was estimated for HFCL, Namrup for the period 1991-2000. Constant elasticity of production function was found for the Namrup fertilizer plant, so CES production function was used for further study. In [3] tested the hypothesis of constant returns to scale using the RLS and ULS technique for the production processes. The hypothesis was accepted and RLS regression is preferred to ULS regression.

In [3] mentioned that India is the 2nd largest consumer of fertilizer in world after China. By 2020 the fertilizer demand in the country is projected to increase to about 41.6 million and especially in eastern and southern region. The country had achieved near self-sufficiency in N and P, with the result that India could manage its requirement of these fertilisers from indigenous industry and imports of all fertilisers except K were nominal. India's fertilizer import has increased to 10.2 million tonnes of fertilizer in 2008-09. In [4] explored the relationship between profitability and liquidity in fertilizer companies of Pakistan by undertaking regression analysis for the period 2005-2011. An inverse relationship between liquidity ratio and profitability was found and it was indicated that working capital can influence the financial position of the fertilizer companies. In [5] analyzed the performance of the fertilizer industry of India in terms 31st March 2009. The study was conducted based on ratio analysis, t- test and z-test. For the study from the list of 76 industries only 60 industries were considered whose data were available. Financial performance of all the industries was found to be satisfactory and over the time it is one of the consistently growing industries. In [6] estimated technical efficiency of small scale soap industry using Cobb –Douglas function for deterministic model, where mean technical efficiency is 47%. In [7] study reveals technical efficiency depends on the assumption made about the probability distribution of the one sided error term. In [8] reveals that technical efficiency is highly influenced by specification of the frontier production function. In [9,10] stochastic production frontier is estimated for two periods 1995-96 and 2000-01 for 101 industries at the 5-digit PSIC. The results show that there has been some improvement in the efficiency of the large scale manufacturing sector.

2. Description of the data and empirical methodology

1. Data

The main source of data, used for the study is secondary data drawn from the annual reports of the selected unit from 2003-2013.2.

2. Measurement of output

The variable output (V) has been defined as gross value added. The value of output has been deflated by the commodity price index (wholesale price index or WPI), compiled from different volumes of the 'Index Numbers of Wholesale Prices in India'. The index numbers for the years 2005-2013 were given at the base 2004-05, whereas for the rest of the period (2003-2004) the base year is 1995-96. The price index corresponding to the years 2003-2004 have, therefore, been converted into the 2004-05 base before deflating the output series.

3. Measurement of capital

The perpetual inventory method, which is based on the relationship between the capital stock at a point of time and investments up to that point, has been used for this purpose. Let Ko denote the base year capital stock, $I_t$the gross investment (at base year prices) in fixed assets in year t, then fixed capital stock in year T denoted by K_T is given by:

$$Kt = Ko + \sum_{t=0}^{T} It$$

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The gross investment it is given by:

$$It = [B_t - B_{t-1} + D_t]/P_t$$

Where B_t is the book of fixed assets at the end of year t, D_t is the amount of depreciation allowances made during year t and P_t is the capital goods price deflator.

The capital goods price deflator is a weighted average of price indices of value of investment on completion of construction and installation works and on purchases of equipment and instruments, the weights being relative magnitudes (50%) of these two categories of assets in the base year. For construction, the implicit price deflator is computed as the ratio of the index of gross domestic capital formation at current and constant (2004-2005) prices obtained from the RBI, Statistical Handbook of Indian Economics is used. The official Wholesale Price Index Number of Machinery and Transport Equipment of 1993-94 from the RBI is used. It is then converted 2004-05 base.

4. Measurement of labour

In case of labour, the stock available to the industry is the number of persons employed by it during a year. Total employees are used as a measure of labour, as it includes both workers as well as persons other than workers.

The conventional approach of production postulates a well-defined relationship between vectors of maximum producible outputs from a vector of factors of production. Weakness in the traditional approach is, it does not permit the distinction between technological change and changes in the efficiency with which known technology is applied to production. In studying the productivity performance of public sector unit (PSU), the distinction between technological progress and changes in technical efficiency is particularly relevant. The amount by which measured total factor productivity is less than the potential; based on best practice available, is traditionally defined as technical inefficiency and technological progress is the change in the best practice production frontier, and establishes its rate by direct estimation of a deterministic frontier production function.Technical efficiency of production is an important element in the pursuit of output growth in PSU. A high level of technical efficiency implies that use of inputs is maximum with the available technology and under this situation output growth can be achieved through the introduction of new technology. Low technical efficiency signals that output growth can be achieved with efficient utilisation current input and available technology.

Let (y', x') be the observed production function of the firm. The production function is technically efficient if $y' = f(x')$ and technically inefficient if $y' < f(x')$. A measure of technical efficiency E is given by $E = y'/f(x')$, which must lie between 0 and 1.Pioneer work in this field was undertaken by Farewell (1957) who provided the basic conceptual framework for estimation of efficiency. His approach consists of considering the input – output ratios for constructing the convex hull of observed ratios. The frontier model has developed in two stages, the first stage is the deterministic model, and the second stage is a more flexible stochastic model.A deterministic frontier model can be written as:

$$Y_i = f(X_i, \beta) \exp(-u_i)$$

Where Y_i is a scalar output of producer (unit), X_i is a vector of inputs used by producer ($X_i = (X^1, \ldots, X^n) > 0$), $f(X_i, \beta)$ is the deterministic frontier and β is the vector of parameters to be estimated, u_i represents inefficiency and is assumed to be a non-negative random variable. Technical efficiency is defined as the ratio observed output to maximum potential output.

$$TE_i = f(X_i, \beta) \exp(-u_i) / f(X_i, \beta) = \exp(-u_i), \quad 0 < TE \leq 1$$

Y_i achieves the maximum value of $f(X_i, \beta)$ and $TE_i = 1$ if $u_i = 0$. Otherwise $u_i \neq 0$ provides the shortfall of observed output from the maximum potential output.In deterministic frontier any shortfall in observed output from maximum output is attributed to technical inefficiency. But in reality shortfall in output is affected not only by producer's inefficiency but also by random shocks such as measurement errors and weather conditions that are beyond producer's control.

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The stochastic frontier model or the composed error model, in which it is assumed that error term is composed of two parts: a symmetric component that permits random variation of the frontier across firms and captures measurement error and random shocks outside firm's control, and a one sided component captures the effect of inefficiency.A stochastic frontier model can be written as:

$$Y_i = f (X_i, \beta) \exp (v_i - u_i),$$

In this model error component consist of two components; v_i which represents components beyond the control of a producer and u_i represents inefficiency component. v_i is a symmetrical random variable and i.i.d. $N(0, \sigma^2_v)$. u_i is a non-negative , one-sided random variable and is the inefficiency part. v_i and u_i are distributed independently of each other and of x_i .

$$TE_i = f (X_i, \beta) \exp (v_i - u_i) / f (X_i, \beta) \exp v_i = \exp (-u_i), 0 < TE \leq 1.$$

Y_i achieves its maximum value of $f (X_i, \beta) \exp v_i$ and $TE_i= 1$ if $u_i=0$, otherwise $u_i \neq 0$ indicates shortfall of output as firms are not making most of its inputs and technology.For a Cobb-Douglas function, if the frontier is deterministic, it is written as:

$$Y= A L^{\alpha} K^{\beta} e^{-u}$$

Taking logarithm on both side of the equation, we get

$\ln(Y) = a + \alpha \ln L + \beta \ln K - u$

In our analysis of technical efficiency, we use a Cobb- Douglas function which has a stochastic function rather than deterministic function:

$\ln(Y) = a + \alpha \ln L + \beta \ln K + v - u$

Where Y is output, L labour, K capital and the error term is assumed to be non-negative.

Table 3. Summary statistics of variables

Variables	Mean	Std. Dev.	Min	Max
Lnoutput	9.137151	0.765999	8.104342	10.28121
Lnlabour	7.188155	0.2070367	6.898715	7.499424
Lncapital	11.39971	0.3130239	10.90235	11.64352

Source: Authors calculation

Table 4. Estimates of stochastic production function (exponential distribution)dependent variable value added output in natural logarithms

Variables (all in natural logarithms)	Coefficients	Standard error	t-ratio(pvalue)
Constant	43.482	14.917	2.91(0.004)
Labour	-3.737	1.034	-3.62 (0.000)
Capital	-0.945	0.853	-1.10 (0.268)
Variance Parameters			
Sigma_v	0.247	0.11	2.24
Sigma_u	0.344	0.184	1.91
Sigma2	0.179	0.109	1.64
Lambda	1.391	0.260	5.35
Log likelihood	-5.381		
LR test of error u	1.44 (0.105)		

Source: Authors calculation

The Tables3 and 4 gives the estimates of stochastic production frontier model. Only the negative coefficient of labour is significant, which indicates overuse of labour. It is found that labor effect is negative, implying that the number of workers is much more than that of actual production workers needed. If the employees of an industry are industrious and trained, the production will be increased. The sum of the elasticity's of the explanatory variables indicates the returns to scale of the production. The sum of the elasticity's is -4.288, which is indicative of decreasing returns-to-scale. The null hypothesis H0: $\sigma_u^2 = 0$ against the alternative hypotheses H1: $\sigma_u^2 > 0$, is tested with likelihood-ratio test, to judge technical efficiency or inefficiency.

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Table 5. Estimates of technical efficiency

Year	T.E
2003	0.335
2004	0.113
2005	0.409
2006	0.300
2007	0.105
2008	0.307
2009	0.194
2010	0.477
2011	0.216
2012	0.137
2013	0.188

Source: Calculated by the author

The LR= 1.44 is significant at 10% significance label, which leads to rejection of null hypothesis, i.e., efficiency exist in the model.Over the year technical efficiency is declining as seen in Table 5, which is indicative of the need to improve the quality of manpower and technology. The average efficiency of the firm is around 33%. Being an old industry the unit efficiency is low. The plant has not experienced technological innovation and it is running on repair and revamp. In addition to it, the plant also experiences shortage of inputs such as natural gas, ammonia, CO_2.BVFCL is the only large unit producing fertilizer in whole of the NE states, but the cost of production has been high due to use of old technology, which are not energy efficient, thus the burden of subsidy is also increasing at the same time. The subsidy provided to unit depends on the amount it produces and its demand.

Table 6. Relation between subsidy, sales, production, and cost of production (Rs in Lakhs)

Year	Subsidy	Sales	Production	Cost of Production
2003	570	7272	302708	18564
2004	2312	12170	389293	13921
2005	2364	12469	334317	14441
2006	3469	9946	385035	18930
2007	13158	15317	503026	25224
2008	9381	15994	553004	25406
2009	3827	11245	308714	26050
2010	8416	17762	519744	26089
2011	22504	17589	458893	37441
2012	23135	17449	449794	39329
2013	29026	27803	551891	48818

Source: Annual Report of BVFCL

The subsidy burden for BVFCL has been on a continuous rise due to use of vintage technology. This rise in subsidy bill may have impact the financial performance of BVFCL, hence analysis has been undertaken to identify the impact.Table 6 reflects that subsidy, sales, amount of production and cost of production has a positive relation and all the four variables move in the same direction.

Table 7. Financial ratio and subsidy (Rs in Lakhs)

Year	Subsidy	Current ratio	Net working capital	Debt/equity	Return on assets
2003	570	1.105	937	0.608	-8.260
2004	2312	1.282	3977	1.075	-9.055
2005	2364	1.141	1265	1.056	3.961
2006	3469	0.679	-3497	1.266	-15.979
2007	13158	1.508	4182	1.361	10.429
2008	9381	1.965	7858	1.633	-18.866
2009	3827	1.160	1626	1.881	-41.058
2010	8416	1.411	6282	2.125	-5.544
2011	23135	2.047	17828.08	2.461	-17.769
2012	29026	2.171	20481.38	2.912	-28.301
2013	23135	2.439	30118.95	3.173	-7.325

Source: Annual Report of BVFCL and Calculated by author

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As Table 7 indicates, the current ratio of the firm is on rising trend which indicates that company assets is more than its liabilities, as with increasing subsidy the burden of liability on the company is low. The rising subsidy leads to an increase in current assets, which provides acceptable label of net working capital. The company is not able to use its assets efficiently as indicated by increasing the debt-equity ratio and a falling return on assets ratio. Subsidy and fertilizer production: The increased production will be accompanied by increased cost of production. Along with them the subsidy provided will also be on continuous rise.

Table 8. Relation between subsidy, production, and cost of production (Rs in Lakhs)

Year	Subsidy	Production	Cost of Production
2003	570	302708	18564
2004	2312	389293	13921
2005	2364	334317	14441
2006	3469	385035	18930
2007	13158	503026	25224
2008	9381	553004	25406
2009	3827	308714	26050
2010	8416	519744	26089
2011	22504	458893	37441
2012	23135	449794	39329
2013	29026	551891	48818

Source: Annual Report of BVFCL

The production of fertilizer and subsidy seems to have a positive relation. With the increase in subsidy the burden on Govt. has increased but with the ongoing process of subsidy, the fertilizer industry is not taking measures to improve its efficiency. Most of the increase in subsidy is due to increase in cost of production and very less due to increase in consumption. The Pearson's Correlation Coefficient (r) [Table 8 and 9] between the total production and total subsidy during 2002-03 and 2012-03 is 0.66 and is found significant at 0.05 levels. Even subsidy and cost of production has strong positive and significant correlation (r = 0.95, significant at 0.05 level). Increase in production is accompanied by increased cost of production, as machines are obsolete and shortage of natural gas supply, thus, subsidy is also increasing.

Table 9. Pearson's correlation coefficient

Variables	Pearson's Correlation Coefficient
Production and Subsidy	0.66*
Cost of production and Subsidy	0.95*

**indicates significant at 5%*

3. Conclusion

BVFCL is the only fertilizer unit under government for the entire NER but still it is yet using age old technology due to which technical efficiency of the unit is low. It has a unitary elasticity of substitution and the negative coefficient of labour indicates that the number of workers is much more than that of actual production workers needed. If the employees of an industry are industrious and trained, the production will be increased.The burden of subsidy bill is increasing but consumption of fertilizer is far below the international level of consumption and is biased towards certain fertilizers. The industry must adopt modern techniques and tools to increase its efficiency in production. Agricultural productivity can be increased by application of scientific techniques with emphasis on fertilizer use. The promoters of the fertilizers must educate the farmers about the proper use of the fertilizer on one hand as well as the techniques of applicationon the other. Various programmes on T.V and radio are telecast to educate farmers on development in agricultural sector and to attain queries of farmers on production. Government Agricultural Departments and fertilizer industries have conducted number of programmes to educate the farmers on benefit of using fertilizers in cultivation and how to use fertilizers efficiently. It becomes necessary for farmers to have good, sound advice and guidance in applying fertilizerand other inputs to local conditions and depending on quality of soils. The use of fertilizers and to reap its benefits it has a relationships with the other modern technological inputs and practice such as improved seeds, plant protection chemicals and practices, irrigation and drainage and improved cultural practices.

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